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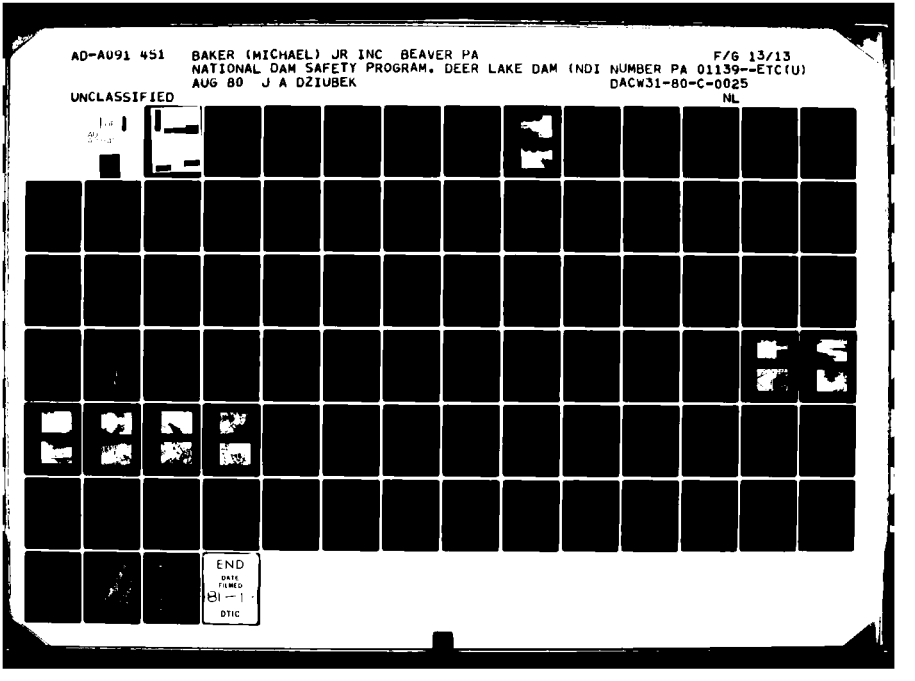

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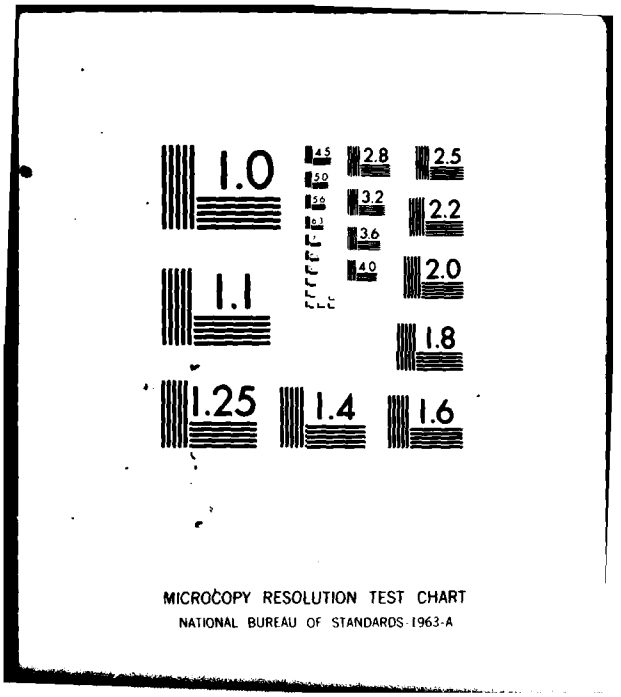
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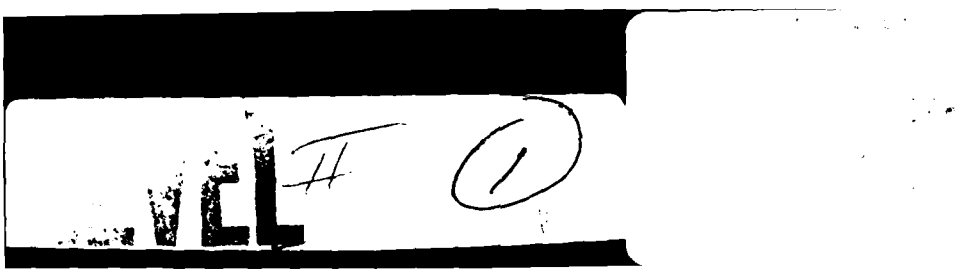
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OHIO RIVER BASIN

DEER LAKE DAM
FAYETTE COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI No. PA 01139
PennDER No. 26-53

(6) PHASE I INSPECTION REPORT,
NATIONAL DAM SAFETY PROGRAM.

Deer Lake Dam (NDI Number PA #1139, PennDER Number 26-53), Ohio River Basin, Fayette County, Commonwealth of Pennsylvania

DACW31-80-C-0025

Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

(10) John A. Dziubek

Prepared by: MICHAEL BAKER, JR., INC.
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(11) August

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PREFACE

This report is prepared under guidance contained in the "Recommended Guidelines for Safety Inspection of Dams," for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Deer Lake Dam, Fayette County, Pennsylvania
NDI No. PA 01139, PennDER No. 26-53
Meadow Run
Inspected 22 July 1980

ASSESSMENT OF GENERAL CONDITIONS

Deer Lake Dam is a "Significant" hazard - "Small" size dam owned and operated by the Deer Lake Improvement Association. The dam was found to be in poor overall condition at the time of inspection.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District, Corps of Engineers, for Phase I Inspection Reports, revealed that the spillways will not pass the spillway design flood (SDF) without overtopping the dam. An SDF in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF) is required for Deer Lake Dam. The 1/2 PMF was chosen because the dam is on the high side of the "Small" size category based on storage capacity. During the 1/2 PMF, the dam is overtopped by a maximum of 1.71 feet for a duration of 11.50 hours. The spillways are capable of passing only 15 percent of the PMF before overtopping begins. The spillways are therefore considered "inadequate." It is recommended that the owners immediately initiate an engineering study to further evaluate the total capacity of the spillways and develop recommendations for remedial measures to reduce the overtopping potential of the dam.

Due to the velocity of seepage through the embankment, the presence of relatively large piping holes, and the undercutting of the toe of the embankment, the dam is classified as being in an "Unsafe" - "Non-emergency" condition.

The inspection revealed certain items of remedial work which should be immediately performed by the owners. Items 1 through 7 below should be completed under the direction of a qualified professional engineer experienced in the design and construction of earth dams and appurtenant structures. These include:

1) The owners should initiate an engineering study to further evaluate the total capacity of the spillways and develop recommendations for remedial measures to reduce the overtopping potential of the dam.

2) Investigate and develop recommendations for the repair of the embankment where seepage and piping are occurring.

3) Relocate the right spillway discharge channel away from the dam and properly fill the eroded toe of the dam.

4) Install a permanent concrete weir for the right spillway.

5) Install upstream closure (control) for the outlet pipe.

6) Restore the top of dam to the same elevation as the spillway training walls.

7) Remove the sediment accumulation from the left spillway crest and develop recommendations for erosion protection by the repair or replacement of the channel bottom.

8) Fill the void on the right side of the central spillway. Also, repair the erosion which is occurring on the downstream face at this location.

9) Remove the vegetation from the left spillway discharge channel.

10) Repoint the stone training walls of the left spillway.

11) Repair the concrete weir of the central spillway.

12) Repoint the stone training walls of the right spillway.

13) Clear the vegetation and debris from the right spillway discharge channel.

14) Clear the vegetation from the downstream slope of the dam.

In addition, the following operational measures are recommended to be undertaken by the owners:

1) Develop a detailed emergency operation and warning system.

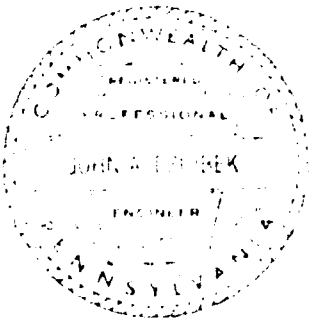
2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance, and operation procedures and records be developed and implemented.

Submitted by:

MICHAEL BAKER, JR., INC.



John A. Dziubek, P.E.
Engineering Manager-Geotechnical

Date: 26 August, 1980

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 12 Sep 80

Overall View from Right Training Wall of Central Spillway Looking at Left Embankment

Overall View from Right Training Wall of Central Spillway Looking at Right Embankment

TABLE OF CONTENTS

APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
DEER LAKE DAM
NDI No. PA 01139, PennDER No. 26-53

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority - The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances - Deer Lake Dam is a 15 foot high earthfill embankment with a total length of 547 feet, including spillways on the left abutment, at the center of the dam, and at the right abutment. The crest width of the dam is 12 feet. The upstream and downstream faces of the embankment have slopes of 2H:1V (Horizontal to Vertical).

The principal spillway, located in the center of the dam, is a concrete, broad-crested weir 54.9 feet wide (see Appendix A 14 for spillway profile). The top width of the weir is 3.1 feet. The upstream and downstream face of the weir are vertical and approximately 0.6 feet high. The sides, consisting of rough stone mortared together, are approximately 1 foot thick. The spillway on the right abutment has a rock pile crest 32.2 feet long with a top width of approximately 1 foot. The channel has a rock bottom and sides of rough stone mortared together. The spillway on the left abutment has a 14.9 foot long earthen crest with a top width of approximately 1 foot. The channel has an earth bottom and sides of rough stone mortared together.

The outlet works consists of a 14 inch cast-iron pipe through the embankment, approximately 5 feet to the left of the principal spillway. The pipe exits through a masonry pit at the downstream toe

where the control valve is located. The pipe discharges into the stream channel 5 feet downstream from the valve pit.

b. Location - Deer Lake Dam is located in Wharton Township, Fayette County, Pennsylvania on Meadow Run, a tributary to the Youghiogheny River. The coordinates of the dam are N 39° 50.6' and W 79° 35.4'. The dam and reservoir can be located on the USGS 7.5 minute topographic quadrangle, Fort Necessity, Pennsylvania.

c. Size Classification - The height of the dam is 15 feet and the reservoir volume at the top of the dam is 543 acre-feet. The dam is therefore in the "Small" size category.

d. Hazard Classification - There is one home approximately 3500 feet downstream, an additional 4 homes approximately 13,500 feet downstream (in a narrow valley) and a rural road which would suffer economic damage if the dam were to fail. It is not expected that any loss of life would occur. The dam is therefore considered to be in the "Significant" hazard category.

e. Ownership - The dam and reservoir are owned by the Deer Lake Improvement Association, P.O. Box 712, Chalkhill, Pennsylvania 15421. Mr. Jack Hughes is the current president of the association.

f. Purpose - The reservoir is used for recreational purposes by the members of the Deer Lake Improvement Association.

g. Design and Construction History - No design information is available for Deer Lake Dam. The dam was built by Mr. Charles H. Seaton of Uniontown, Pennsylvania in 1906 for recreational purposes on his estate. The dam consisted of an earth embankment with the spillway located in the center of the dam. In 1908, Mr. Seaton had auxiliary channels excavated in the left and right abutments of the dam. In 1916, Mr. Seaton had the embankment raised to a height of 4.25 feet above the crest of the main spillway, located in the center of the dam. This work was done at the request of the Water Supply Commission of Pennsylvania (predecessor to the Pennsylvania Department of Environmental Resources [PennDER]). The plans were prepared by Mr. W.S. McClay, Engineer, and are included as Plate 3 in the report.

h. Normal Operational Procedures - The reservoir is typically at the principal spillway crest elevation (Elevation 1929.0 feet Mean Sea Level [M.S.L.]). There are no written formal operational procedures for Deer Lake Dam.

1.3 PERTINENT DATA

a. Drainage Area (square miles) - 4.93

b. Discharge Capacity at Dam Site (cfs) -

Combined Spillways Capacity at Minimum Top of Dam (El. 1931.5 ft. M.S.L.) -	1050

c. Elevation (feet above M.S.L.) -

Average Top of Dam -	1932.0
Minimum Top of Dam -	1931.5
Normal Pool -	1929.0
Maximum Design Pool -	Unknown
Crest of Principal Spillway Weir -	1929.0
Maximum Tailwater -	Unknown
Streambed at Toe of Dam -	1916.5±

d. Reservoir (feet) -

Length of Maximum Pool -	5400
Length of Normal Pool -	4630

e. Storage (acre-feet) -

Top of Dam (El. 1931.5 ft. M.S.L.) -	543
Normal Pool (El. 1929.0 ft. M.S.L.) -	359

f. Reservoir Surface (acres) -

Top of Dam (El. 1931.5 ft. M.S.L.) -	96.4
Normal Pool (El. 1929.0 ft. M.S.L.) -	60

g. Dam -

Type -	Earthfill
Length (feet) -	547
Height (feet) -	15
Crest Width (feet) -	12
Side Slopes - Upstream -	2H:1V
Downstream -	2H:1V

Zoning - No information on zoning is available.
Impervious Core - In the correspondence in the PennDER File No. 26-53, there is information indicating the presence of a clay

puddle core; however, Plate 3 does not show the clay core throughout the length of the embankment.

Cut-off - No information on cut-off is available.

Drains - None

h. Diversion and Regulating Tunnel - None

i. Spillways -

Left Abutment:

Type - Earth channel, heavily vegetated, with vertical sides of rough stone mortared together.

Location - Approximately 31 feet from left abutment.

Length of Crest Perpendicular to the Direction of Flow (feet) - 14.9

Top Width of Crest Parallel to the Direction of Flow (feet) - 1+

Crest Elevation (feet M.S.L.) - 1929.9

Gates - None

Downstream Channel - An earth channel with mortared stone sides and a 9 percent slope extending to below the toe of the dam. The channel is heavily vegetated with weeds and brush and ends in woods at the toe of the dam. There is exposed rock paving on the lower portion of the channel.

Center of Embankment:

Type - Concrete, broad-crested weir with vertical upstream and downstream faces and channel sides of rough stone mortared together.

Location - Approximately 162 feet from the left abutment.

Length of Crest Perpendicular to the Direction of Flow (feet) - 54.9

Top Width of Crest Parallel to the Direction of Flow (feet) - 3.1

Crest Elevation (feet M.S.L.) - 1929.0

Gates - None

Downstream Channel - A channel with a concrete bottom, mortared stone vertical sides extending for 16.9 feet downstream of the spillway crest, and a 15 percent slope. This channel empties to a set of stone stairs which drop 8.5 feet to the natural stream bottom.

Right Abutment:

Type - Rock pile crest with vertical sides of rough stone mortared together.

Location - Approximately 17 feet from the right abutment.

Length of Crest Perpendicular to the Direction of Flow (feet) -	32.2
Top Width of Crest Parallel to the Direction of Flow (feet) -	1+
Crest Elevation (feet M.S.L.) -	1929.2
Gates -	None

Downstream Channel - A channel with a rock bottom, mortared stone vertical sides extending for approximately 30 feet beyond the spillway crest, and a 15 percent slope. The channel empties into a natural channel that meanders along the toe of the dam and connects with the normal stream channel.

j. Outlet Works - The outlet works consist of a 14 inch cast-iron pipe placed through the embankment. The pipe is located approximately 5 feet to the left of the left side of the principal spillway in the center of the dam. It connects to a masonry pit for the valve at the downstream toe of the dam. A gate valve can be operated in the pit to drain the reservoir. The invert of the pipe at its outlet is El. 1917.6 ft. M.S.L.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The review of information for this dam included PennDER File No. 26-53. The following information is contained in the correspondence file for this dam:

1) Initial inspection report by an engineer of the Water Supply Commission of Pennsylvania dated 4 March 1916 and continuing inspection reports through 4 August 1961.

2) Applications and permits to drawdown the reservoir to make minor repairs to the embankment and spillways from 12 August 1965 to 27 July 1967.

3) General correspondence concerning condition of the dam and needed repairs from 29 March 1916 to 11 September 1957.

4) Water Resources Inventory Form.

5) Drawing by W.S. McClay, Engineer, showing proposed increased embankment dated July 1916.

Information on the design or plans of the dam was not available.

2.2 CONSTRUCTION

Deer Lake Dam was built in 1906 for recreational purposes by Mr. Charles H. Seaton of Uniontown, Pennsylvania. In 1908, auxiliary spillway channels were excavated into the left and right abutments. The dam was elevated in 1916, at the request of the Water Supply Commission, to 4.25 feet above the crest of the principal spillway in the center of the embankment.

2.3 OPERATION

There are no operation records available for this dam. The reservoir is normally at the principal spillway crest level.

2.4 EVALUATION

a. Availability - The information reviewed is readily available from PennDER File No. 26-53. Additional

information was obtained by interviewing the owners.

b. Adequacy - The information available is adequate for a Phase I Inspection of this dam.

c. Validity - There is no reason to doubt the validity of the information reviewed.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - The inspection was performed on 22 July 1980. A rainfall of approximately 2 inches occurred the night before the inspection. During the inspection, intermittant showers occurred. According to the owners' representative, the pool level was a couple of inches below the crest of the central spillway the day before the inspection. The dam and appurtenant structures were found to be in poor overall condition at the time of inspection. The amount, height, and thickness of the vegetation on the downstream slope and toe areas made a visual inspection of these areas difficult. Noteworthy deficiencies observed during the visual inspection are described in the following paragraphs. The complete visual inspection check list, field sketch, top of dam profile, and typical cross-section are presented in Appendix A.

b. Dam - The dam was covered with a thick growth of vegetation making the visual inspection difficult. The following is a list of deficiencies observed during the visual inspection of the embankment and abutments.

1) Seepage was observed exiting from 3 holes approximately 6 to 8 inches in diameter located at the right end of the right embankment. The estimated volume of flow from these holes was 25 g.p.m. The water was clear; however, the velocity was great enough to pick up an occasional grain of soil and move it further downstream. According to the owners' representative, this seepage has been occurring for the past several years, but he could not say whether the holes were more developed or the volume of flow has increased. In addition, he was not able to tell if the volume of flow was related to the reservoir level.

2) The top of dam is lower on the right embankment than the level of the central spillway training walls.

3) Some erosion has occurred to the right of the right training wall of the central spillway. A void, approximately 2 feet deep by 8 inches in diameter, was present in this area. The cause of this void was not readily apparent.

4) The discharge channel of the right spillway curves back toward the dam and is undercutting the toe of the embankment. A six foot vertical face has been formed at the toe of the dam by this channel.

c. Appurtenant Structures -

1) Left Spillway -

a) The spillway is full of sediment deposits, especially at the location of the foot bridge. All sediment deposits should be removed and recommendations should be made for erosion protection for the channel bottom.

b) The spillway crest is very irregular and should be repaired.

c) The discharge channel is heavily vegetated and should be cleared.

d) The loose stone training walls should be repointed.

2) Central (Principal) Spillway -

a) The concrete weir is cracked and leaking and should be repaired.

b) Some erosion has occurred in the discharge channel to the right of the right training wall. This erosion should be repaired.

3) Right Spillway -

a) The spillway weir consists of loose stone. Consequently, it is very easy for the water to flow through and under the stone and possibly undermine the rest of the spillway structure. It is recommended that a permanent concrete weir be installed for the crest of this spillway.

b) Some of the stones in the training walls were loose and should be repointed.

c) The discharge channel had debris and vegetation which could impede the discharge. This blockage should be removed.

d) The discharge channel curves back toward the dam and is undermining the embankment toe. The channel should be relocated away from the toe and the eroded area repaired.

4) Outlet Works - The outlet works consists of a 14 inch cast-iron pipe with a gate valve located near the downstream end of the central spillway. The valve is operated annually and appears to be in fair condition. A minor amount of flow was exiting the pipe at the time of inspection. It is recommended that upstream closure for the pipe be provided in order to protect the embankment in the event of a pipe rupture.

d. Reservoir Area - The slopes of the reservoir are gently sloped. Some of the area has been developed into residential areas and the rest is forested. A study was conducted by the lake owners in 1976 to determine the extent of sedimentation in the reservoir. The study concluded that the reservoir has an average of 3.3 feet of accumulated soft sediment.

e. Downstream Channel - A road bridge is located approximately 200 feet downstream from the dam. This bridge has an approximate opening 30 feet wide by 9.5 feet high and should not constrict the discharge from the dam. The downstream channel slope is slightly less than 1 percent for the first 4000 feet, then it changes to a narrow, steep (gradient greater than 2 percent) channel. There is one home approximately 3500 feet downstream and four homes located approximately 13,500 feet downstream that would suffer economic damage. A township bridge is also located at this spot.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal, written procedures to be followed in the event of an impending failure of the dam. It is recommended that formal emergency procedures be prepared, prominently displayed, and furnished to all operating personnel.

4.2 MAINTENANCE OF DAM

Maintenance of the dam is the responsibility of the Deer Lake Improvement Association. There are no formal inspection and maintenance procedures for Deer Lake Dam. However, the owners cut all vegetation and visually inspect the dam once each year. It is recommended that formal inspection and maintenance procedures be developed and implemented.

4.3 MAINTENANCE OF OPERATING FACILITIES

There are no formal procedures for maintenance of operating facilities; however, once a year the owners of the dam operate the outlet works. It is recommended that procedures for maintenance of operating facilities be developed and implemented.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning procedure in the event of a dam failure. An emergency warning procedure should be developed.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

There are no formal, written operational procedures for Deer Lake Dam. It is recommended that formal, written operational procedures be developed and implemented.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data - There is no detailed hydrologic or hydraulic design information available for Deer Lake Dam.

b. Experience Data - No records concerning the effects of significant floods on the dam and spillway are available.

c. Visual Observation - There is a wooden footbridge over the downstream channel of each of the three spillways; however, these have no effect on flow in the spillways. The spillway on the left abutment is sedimented in, heavily vegetated, and has a crest with an irregular top width. The spillway channel should be cleaned and the bottom should be repaired or replaced for erosion protection. The concrete weir in the central spillway is showing signs of crumbling and should be repaired. The rock pile crest of the right spillway, on the right abutment, is not uniform and in poor condition. The crest should be made uniform and leaks through the crest should be repaired so that water flows over the crest. The downstream channel should be cleaned and a new alignment away from the toe of the dam should be excavated to the natural stream. The sides of the spillway channels are rough stone mortared together. There are cracks in the mortar and some stones are broken loose. Cracks should be filled and loose stones should be repointed.

d. Overtopping Potential - Deer Lake Dam is classified as a "Significant" hazard - "Small" size dam requiring evaluation for a spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF). Since the dam is on the high end of the small size category based on storage capacity, the 1/2 PMF was chosen as the SDF.

The hydrologic capabilities of the dam, reservoir, and spillways were evaluated by routing the 1/2 PMF through the reservoir with the aid of the U.S. Army Corps of Engineers' Flood Hydrograph Package, HEC-1 DB. Analysis of the dam and spillways show that the dam will be overtopped by a maximum of 1.71 feet for a duration of 11.50 hours. The

spillways are capable of passing 15 percent of the PMF before overtopping of the dam begins.

e. Spillway Adequacy - The dam, as outlined in the above analysis, is not capable of passing the 1/2 PMF without overtopping. The spillways are therefore considered "inadequate" according to the recommended criteria.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - The seepage and piping holes located at the right end of the right embankment are a serious threat to the continued safety and stability of this dam. The volume, velocity, the presence of relatively large diameter piping holes, and the occasional migration of a soil grain further downstream, indicate that this area will continue to become progressively worse. It is recommended that the owners immediately retain the services of a qualified professional engineer experienced in the design and construction of earth dams and appurtenant structures to develop recommendations for the repair of this portion of the embankment. The continued undercutting of the toe of the embankment by the discharge channel of the right spillway should be repaired by relocating the channel away from the dam and properly filling this area. In addition, the left spillway bottom should be examined and recommendations made for erosion protection.

b. Design and Construction Data - No design or construction data were available for review. Given the age of the structure (constructed in 1906) and the state-of-the-art in geotechnical engineering and dam design at that time, it is expected that no stability calculations were performed. General experience with slopes of modest heights, inclinations, and materials similar to those of this dam indicates that, in the absence of adverse soil and hydraulic conditions related to unfavorable seepage and piping features, the dam slopes could be shown to satisfy the necessary sliding stability requirements. The real concern is not routine sliding stability of idealized cross-sections but seepage and piping failure modes related to localized soil and hydraulic conditions in the dam embankment and foundation. These failure modes should be addressed in the recommended seepage and piping investigation.

c. Operating Records - Nothing in the readily available operating information indicates cause for concern relative to the structural stability of the dam.

d. Post-Construction Changes - No known changes adversely affecting the structural stability have been performed.

e. Seismic Stability - The dam is located in Seismic Zone 1 of the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is a zone of minor seismic activity. Therefore, further consideration of the seismic stability is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety - Deer Lake Dam was found to be in poor overall condition at the time of inspection. Deer Lake Dam is a "Significant" hazard - "Small" size dam requiring an SDF in the range of the 100-year flood to the 1/2 PMF. The 1/2 PMF was chosen as the SDF because the dam is on the high side of the "Small" size category based on storage capacity. As presented in Section 5, the spillways and reservoir are not capable of passing the 1/2 PMF without overtopping the dam. The spillways are capable of passing only 15 percent of the PMF before overtopping of the dam begins. Therefore, the spillways are considered "inadequate".

The visual inspection revealed a number of features, particularly those related to seepage and piping phenomena, that are in need of immediate attention. It is recommended the owners retain the services of a qualified professional engineer experienced in the design and construction of earth dams and appurtenant structures to investigate the seepage and piping, to develop recommendations for the repair of this portion of the embankment, and to develop recommendations for erosion protection by repair or replacement of the left spillway channel bottom.

In summary, Deer Lake Dam is classified as being in an "Unsafe" - "Non-emergency" condition.

b. Adequacy of Information - The information available and the observations made during the visual inspection are considered sufficient for this Phase I Inspection Report.

c. Urgency - The owner should immediately initiate the action discussed in paragraph 7.2.

d. Necessity for Additional Data/Evaluation - As discussed in paragraph 7.1.a., a detailed investigation of the seepage and piping should be immediately initiated.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed certain items of remedial work which should be immediately performed by the owners.

Items 1 through 7 below should be completed under the direction of a qualified professional engineer experienced in the design and construction of earth dams and appurtenant structures. These include:

1) The owners should initiate an engineering study to further evaluate the spillways capacity and develop recommendations for remedial measures to reduce the overtopping potential of the dam.

2) Investigate and develop recommendations for the repair of the embankment where seepage and piping are occurring.

3) Relocate the right spillway discharge channel away from the dam and properly fill the eroded toe of the dam.

4) Install a permanent concrete weir for the right spillway.

5) Install upstream closure (control) for the outlet pipe.

6) Restore the top of dam to the same elevation as the spillway training walls.

7) Remove the sediment accumulation from the left spillway crest and develop recommendations for erosion protection by the repair or replacement of the channel bottom.

8) Fill the void on the right side of the central spillway. Also, repair the erosion which is occurring on the downstream face at this location.

9) Remove the vegetation from the left spillway discharge channel.

10) Repoint the stone training walls of the left spillway.

11) Repair the concrete weir of the central spillway.

12) Repoint the stone training walls of the right spillway.

13) Clear the vegetation and debris from the right spillway discharge channel.

14) Clear the vegetation on the downstream slope of the dam.

In addition, the following operational measures are recommended to be undertaken by the owners:

1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance and operation procedures and records be developed and implemented.

APPENDIX A

VISUAL INSPECTION CHECK LIST, FIELD SKETCH, TOP OF DAM PROFILE, AND TYPICAL CROSS-SECTION

Phase 1
Visual Inspection
Check List

Name of Dam Deer Lake Dam County Fayette State PA Coordinates Lat. N 39°50.6'

NDI # PA 01139
PennDER # 26-53

Long. W 79°35.4'

Date of Inspection 22 July 1980 Weather Raining* Temperature 75° F.

*Note: A 2 in. rainfall occurred in the reservoir vicinity the preceeding night; however, the reservoir level was below the spillway crest the preceeding day.

Pool Elevation at Time of Inspection 1929 ft.** M.S.L. Tailwater at Time of Inspection 1917.4 ft.** M.S.L.

**All elevations referenced to crest of central (principal) spillway, El. 1929.0 ft. M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ulinski
Larry A. Diday
Robert W. Moore

Deer Lake Improvement Association:

Mr. Jack Hughes, President
Mr. Bruce Deemer, Director

Field Review (8 August 1980):

John A. Dziubek
James G. Ulinski

James G. Ulinski Recorder

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: DEER LAKE DAM
NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		

EMBANKMENT

Name of Dam DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	The right spillway discharge channel is currently undercutting a portion of the toe of the dam.	The channel should be relocated away from the toe and that portion of the embankment repaired.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No sloughing was observed. Some erosion has occurred on the right side of the central spillway. Other areas of erosion were not readily apparent due to the high and thick vegetation on the embankment.	The eroded area should be filled.

EMBANKMENT

Name of Dam DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The minimum crest elevation of 1931.5 ft. M.S.L. is below the elevation of the spillway walls. The horizontal alignment is acceptable.	The dam should be raised to the top of the spillway walls, El. 1932.0 ft. M.S.L.
RIPRAP FAILURES	No failures were observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems were observed at the abutments. The right side of the central spillway has some eroded areas. A void is present in this area approximately 2 ft. in depth and 8 in. in diameter. The cause of this void is not readily apparent.	

EMBANKMENT

Name of Dam DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Seepage is exiting below the right end of the right embankment. This seepage has formed 3 separate piping holes 6 to 8 in. in diameter. The total volume of flow is approximately 25 g.p.m. The flow appears to be clear except for an occasional particle of soil being moved further downstream. This seepage has been noted by the owners for the past several years.	Although the seepage has been noted for several years, the volume and velocity of the seepage and the presence of piping holes are a serious threat to the continued safety and stability of this dam. It is recommended that the owners immediately engage a qualified professional engineer experienced in the design and construction of earth dams and appurtenant structures to develop recommendations for the repair of this portion of the embankment.
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS

Name of Dam: DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The outlet pipe is a 14 in. C.I.P. The pipe appeared to be in fair condition at the outlet end.	
INTAKE STRUCTURE	The intake is submerged and no details are known.	Provide upstream closure for the outlet pipe.
OUTLET STRUCTURE	The outlet of the pipe appeared to be in reasonable condition. The valve pit was also in fair condition. A minor amount of flow was exiting from the pipe.	
OUTLET CHANNEL	The pipe discharges into the channel for the central spillway. No problems were observed.	
EMERGENCY GATE	The gate valve for the pipe is located near the discharge end of the pipe. The valve is usually opened at least once a year to check its condition.	Provide upstream closure for the outlet pipe.

UNGATED SPILLWAY
(LEFT SPILLWAY)

Name of Dam: DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The spillway consists of an earth bottom with sides of rough stone mortared together. The spillway is full of sediment deposits and has an irregular crest. It is unknown if this spillway is cut into a stable rock or if it is paved. Indications are that it is paved further downstream.	All sediment deposits should be removed and an examination should be undertaken to make recommendations for erosion protection by repair or replacement of the channel bottom.
APPROACH CHANNEL	The approach channel consists of a sandy beach.	
DISCHARGE CHANNEL	The discharge channel consists of an earth bottom with sides of rough stone mortared together. The channel has sediment deposits, debris, heavy vegetation, and some of the mortar in the sides is cracked and loose. Farther downstream from the dam the channel is paved.	The channel should be cleaned of all sediment, debris, and heavy vegetation. Cracks and loose stone should be repointed.
BRIDGE AND PIERS	A wooden footbridge spans the discharge channel. This bridge appears to be in good condition.	

Name of Dam: DEER LAKE DAM

UNGATED SPILLWAY
(CENTRAL [PRINCIPAL] SPILLWAY)

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The spillway consists of a concrete bottom with sides of rough stone mortared together.	The concrete weir shows signs of crumbling and should be repaired.
APPROACH CHANNEL	The reservoir serves as the approach channel.	
DISCHARGE CHANNEL	The discharge channel consists of stone steps mortared together. Some erosion has occurred on the right side of the spillway.	The area of erosion should be repaired.
BRIDGE AND PIERS	A wooden footbridge spans the discharge channel. The bridge appears to be in good condition.	

UNGATED SPILLWAY
(RIGHT SPILLWAY)

Name of Dam: DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The spillway consists of a loose rock bottom and sides of rough stone mortared together. The crest is irregular and water flows through parts of the crest instead of over it.	The crest should be repaired and a permanent concrete weir installed.
APPROACH CHANNEL	The reservoir serves as the approach channel.	
DISCHARGE CHANNEL	The discharge channel consists of a stone bottom with sides of rough stone mortared together. There was some debris in the channel. Some of the stones in the sides had cracks in the mortar and were loose. The channel alignment curves back toward the dam and has seriously undercut the toe of the embankment.	Debris should be removed from the channel. Any loose stones or stones with cracks in the mortar should be repointed. The discharge channel should be realigned away from the toe and the toe erosion repaired.
BRIDGE AND PIERS	A wooden footbridge with a concrete pier spans the discharge channel. The bridge and pier appear to be in good condition.	

GATED SPILLWAY - Not Applicable

Name of Dam: DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT		

INSTRUMENTATION

Name of Dam: DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHER	A rain gage is located on the left shoreline area. Records have been kept since 1972.	

RESERVOIR

Name of Dam: DEER LAKE DAM

NDI # PA 01139

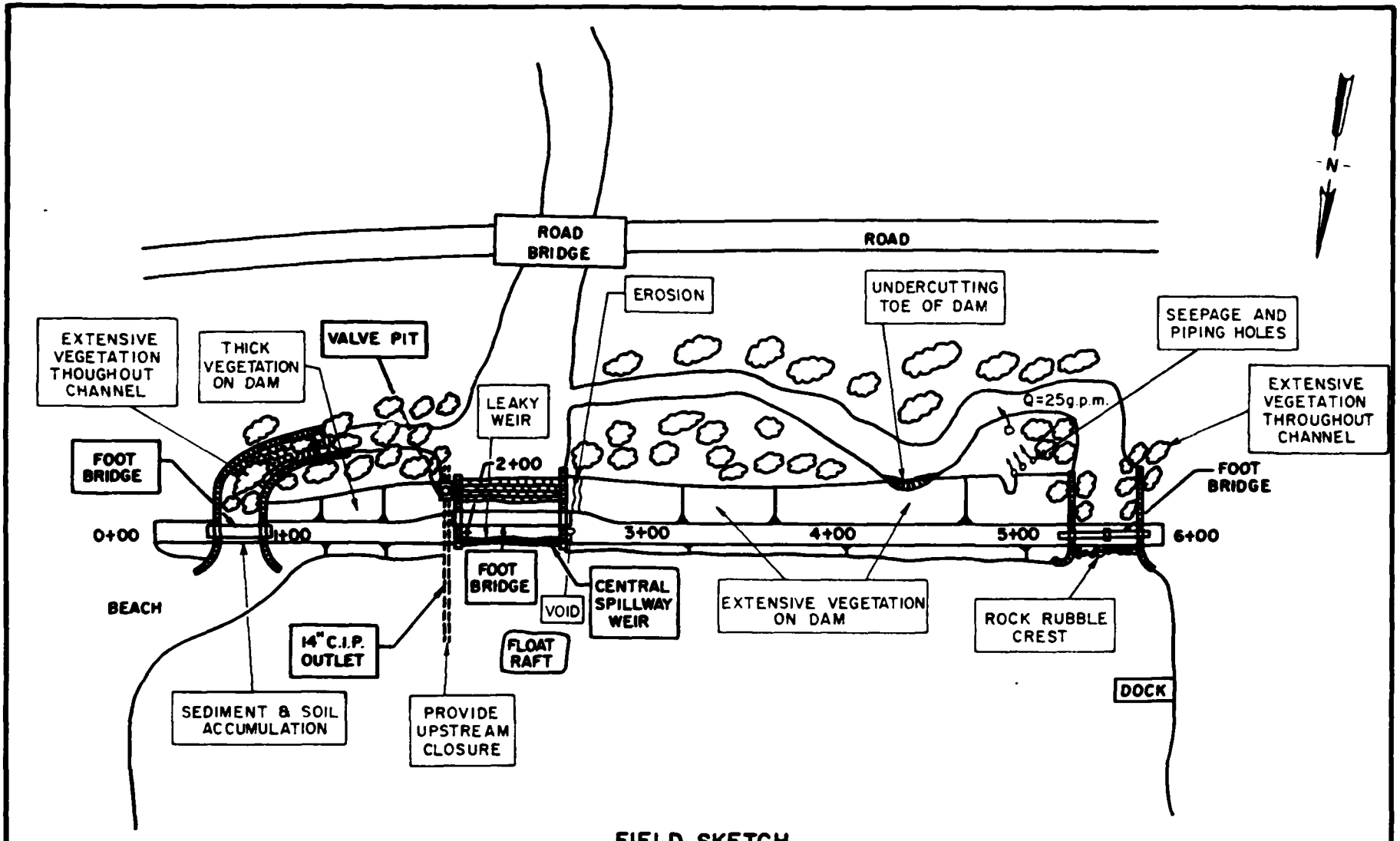
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir slopes are mild with no evidence of instability. Parts of the drainage area have been developed into residential areas and the rest is forested.	
SEDIMENTATION	From a study conducted by the lake owners in 1976, sediment is estimated to be approximately 3.3 ft. deep. The sediment would not impede the current uses of the reservoir.	

DOWNSTREAM CHANNEL

Name of Dam: DEER LAKE DAM

NDI # PA 01139

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	A road bridge is located approximately 200 ft. downstream; however, it is not expected to constrict the flow.	
SLOPES	The downstream channel slope is mild (less than 1%) until approximately 4000 ft. downstream where it changes to a steep slope (greater than 2%).	
APPROXIMATE NO. OF HOMES AND POPULATION	There is one home approximately 3500 ft. downstream and an additional 4 homes approximately 13,500 ft. downstream from the dam which may suffer damage if the dam should fail.	



FIELD SKETCH

DEER LAKE DAM
NDI NO. PA01139
PennDER NO. 26-53
INSPECTED 22 JULY 1980
SCHEMATIC - NOT TO SCALE

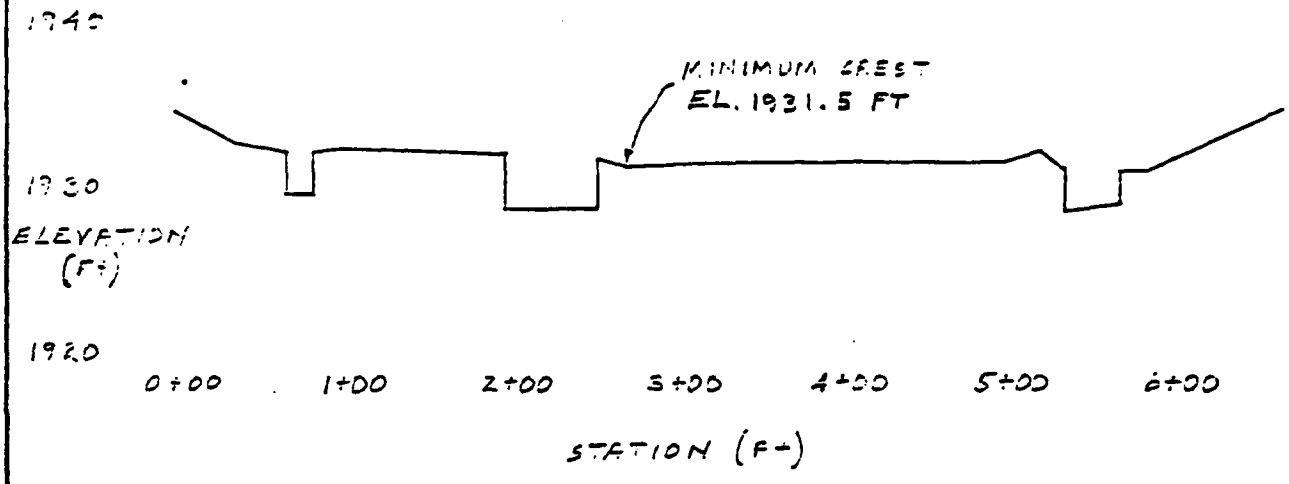
MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

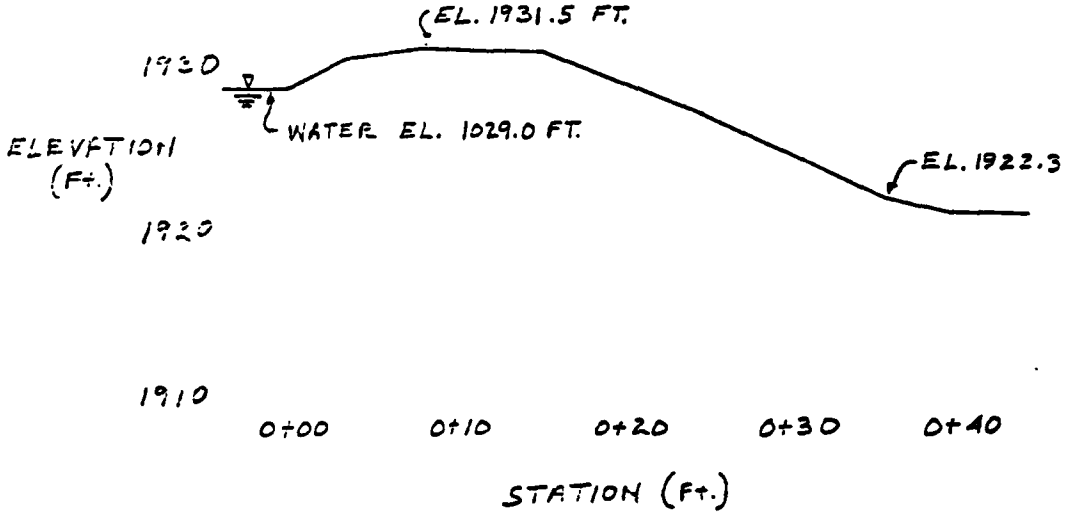
DEER LAKE DAM
TOP OF DAM PROFILE
TYPICAL CROSS-SECTION

DATE OF INSPECTION - 22 July 1980

TOP OF DAM PROFILE



CROSS SECTION AT STA 2+70



APPENDIX B

ENGINEERING DATA CHECK LIST

ENGINEERING DATA
CHECK LIST
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: DEER LAKE DAM
NDI # PA 01139

ITEM	REMARKS
PLAN OF DAM	No design plan of the dam is available. See the field sketch in Appendix A for a schematic plan of the dam.
REGIONAL VICINITY MAP	A USGS 7.5 minute quadrangle map, Fort Necessity, PA was used to prepare the vicinity map which is enclosed in this report as the Location Plan (Plate 1).
CONSTRUCTION HISTORY	The dam was built by Mr. Charles H. Seaton of Uniontown, PA in 1906 for recreational purposes on his estate. Later revisions to the embankment (1916) were designed by Mr. W.S. McClay, Engineer.
TYPICAL SECTIONS OF DAM	See Plate 3 for embankment sections circa 1916.
HYDROLOGIC/HYDRAULIC DATA	No information available
OUTLETS - PLAN, DETAILS, CONSTRAINTS, and DISCHARGE RATINGS	No information available
RAINFALL/RESERVOIR RECORDS	A rain gage is located on the left shoreline area of the reservoir. Rainfall records have been kept since 1972. No reservoir records are available.

Name of Dam: DEER LAKE DAM

NDI # PA 01139

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	None are available; see Appendix F for regional geology.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	See Plate 3 of this report for circa 1916 profile and cross-sections.
BORROW SOURCES	No information available

Name of Dam: DEER LAKE DAM

NDI # PA 01139

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	The spillway capacity was increased in 1908 by the addition of two auxiliary channels, one at each abutment. In 1916, the embankment was raised and riprap provided on the upstream face.
HIGH POOL RECORDS	No information available
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Other than various inspections performed by PennDER or its predecessors, the only study has been to determine the extent of sediment accumulation in the reservoir. This study was performed by members of the Deer Lake Improvement Association in 1976.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None available

Name of Dam: DEER LAKE DAM

NDI # PA 01139

ITEM	REMARKS
SPILLWAY PLAN	See the field sketch in Appendix A for the schematic.
SECTIONS and DETAILS	None available
OPERATING EQUIPMENT PLANS & DETAILS	No information available

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 4.93 sq.mi. (rural land, primarily forests and pastures)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1929.0 ft. M.S.L. (359 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1931.5 ft. M.S.L. (543 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1931.5 ft. M.S.L. (minimum top of dam)

SPILLWAY: Left spillway/central spillway, principal/right spillway

a. Crest Elevation 1929.9 ft. M.S.L./1929.0 ft. M.S.L./1929.2 ft. M.S.L.
b. Type Earth, open channel/Concrete, open channel/Rock, open channel
c. Width of Crest Parallel to Flow 1± ft./3.1 ft./1± ft.
d. Length of Crest Perpendicular to Flow 14.9 ft./54.9 ft./32.2 ft.
e. Location Spillover Left abutment/center/right abutment
f. Number and Type of Gates None

OUTLET WORKS: Facilities for dewatering reservoir

a. Type 14 in. C.I.P.
b. Location Approximately 5 ft. to the left of the central spillway
c. Entrance Inverts Unknown
d. Exit Inverts El. 1917.6 ft. M.S.L.
e. Emergency Drawdown Facilities Valve located in masonry valve pit at downstream toe of dam

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE No records available

APPENDIX C

PHOTOGRAPH LOCATION PLAN AND PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam

Top Photo - (OV-T) View from Right Training Wall of Central Spillway Looking at Left Embankment

Bottom Photo - (OV-B) View from Right Training Wall of Central Spillway Looking at Right Embankment

Photograph Location Plan

Photo 1 - View of Upstream Side of Central Spillway

Photo 2 - View from Left Training Wall of Central Spillway Looking across Weir

Photo 3 - View of Central Spillway Weir Looking Upstream from Left Training Wall

Photo 4 - View Looking Upstream at Central Spillway

Photo 5 - View of Upstream Side of Left Spillway

Photo 6 - View of Left Spillway Bridge from Left Abutment

Photo 7 - View of Right Spillway from Upstream

Photo 8 - View of Downstream Side of Right Spillway from Right Training Wall

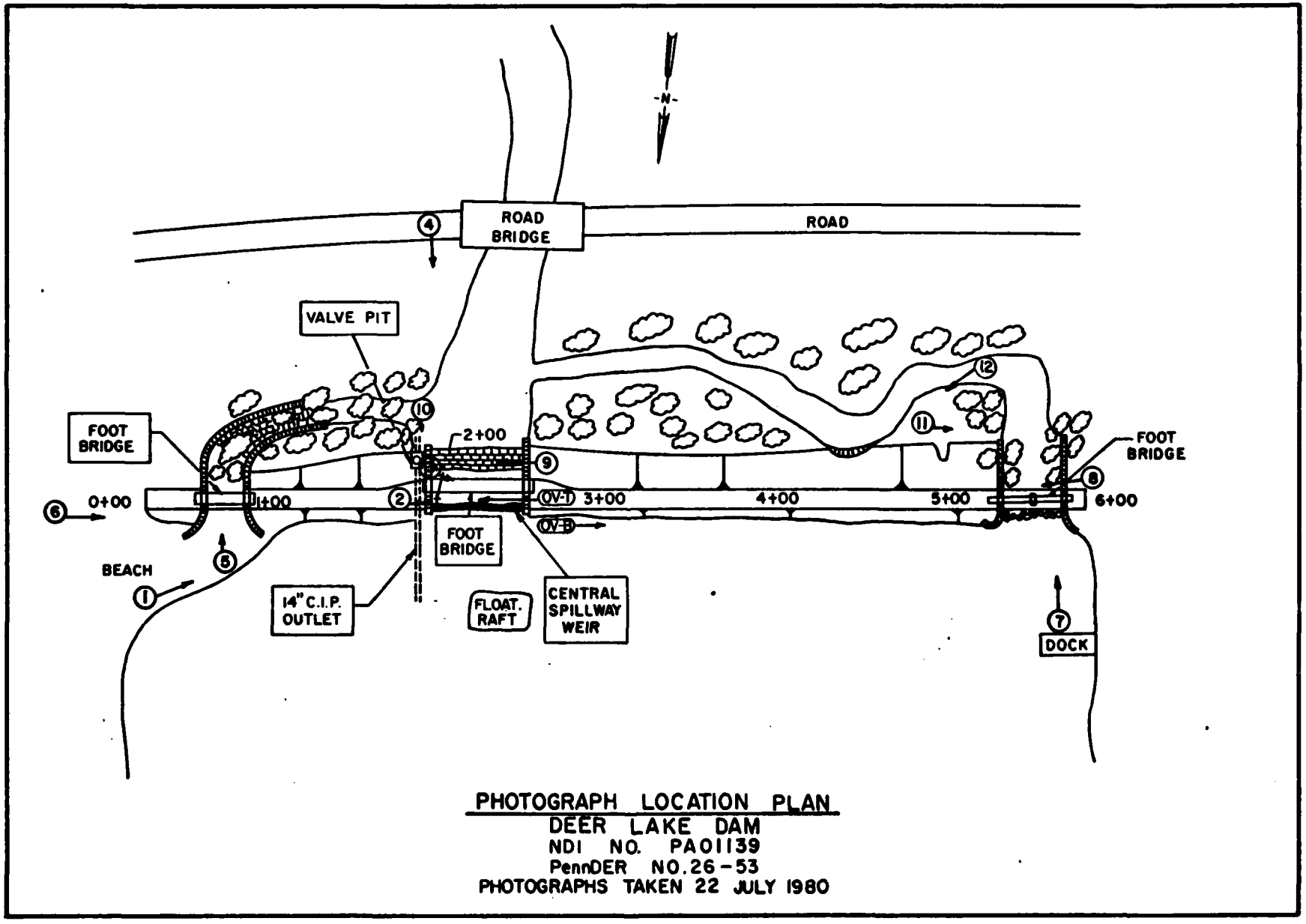
Photo 9 - View of Valve Pit Location for Outlet Pipe

Photo 10 - View of Downstream End of Outlet Pipe

Photo 11 - View of One of the Seepage and Piping Holes at Right Embankment

Photo 12 - View of a Seepage and Piping Hole Downstream of Right End of Right Embankment

Note: Photographs were taken on 22 July 1980.



PHOTOGRAPH LOCATION PLAN
DEER LAKE DAM
NDI NO. PA01139
PennDER NO. 26-53
PHOTOGRAPHS TAKEN 22 JULY 1980

PHOTO 1. View of Upstream Side of Central Spillway

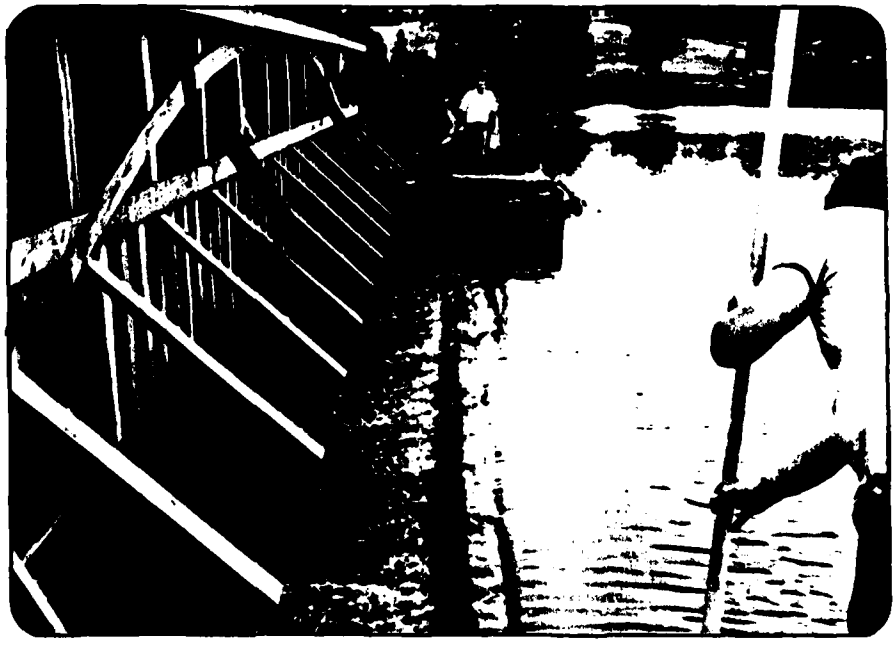


PHOTO 2. View from Left Training Wall of Central Spillway
Looking across Weir

PHOTO 3. View of Central Spillway Weir Looking Upstream from Left Training Wall

PHOTO 4. View Looking Upstream at Central Spillway

PHOTO 5. View of Upstream Side of Left Spillway

PHOTO 6. View of Left Spillway Bridge from Left Abutment

PHOTO 7. View of Right Spillway from Upstream

PHOTO 8. View of Downstream Side of Right Spillway from Right Training Wall

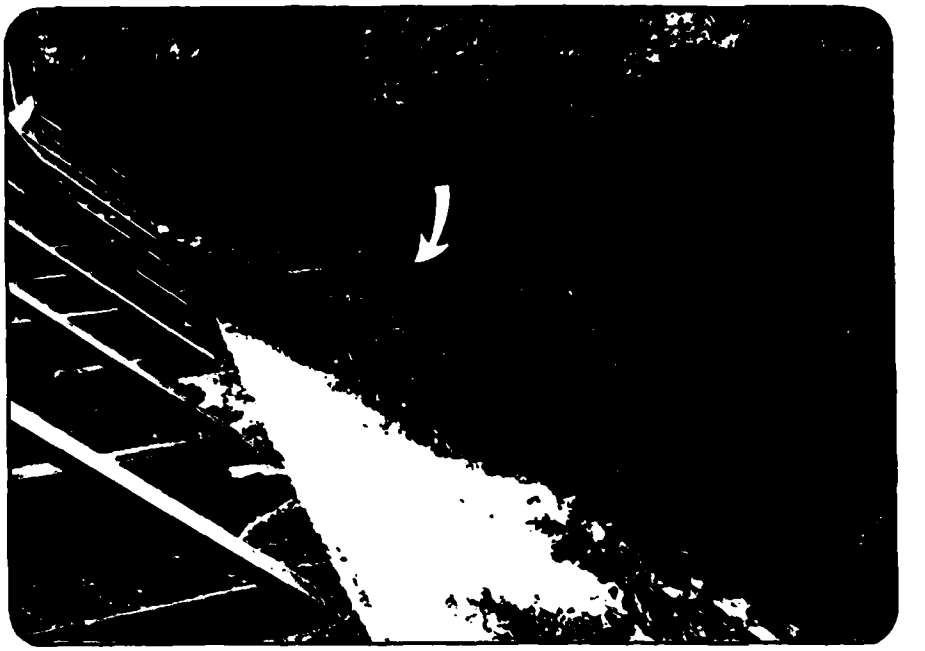


PHOTO 9. View of Valve Pit Location for Outlet Pipe

PHOTO 10. View of Downstream End of Outlet Pipe

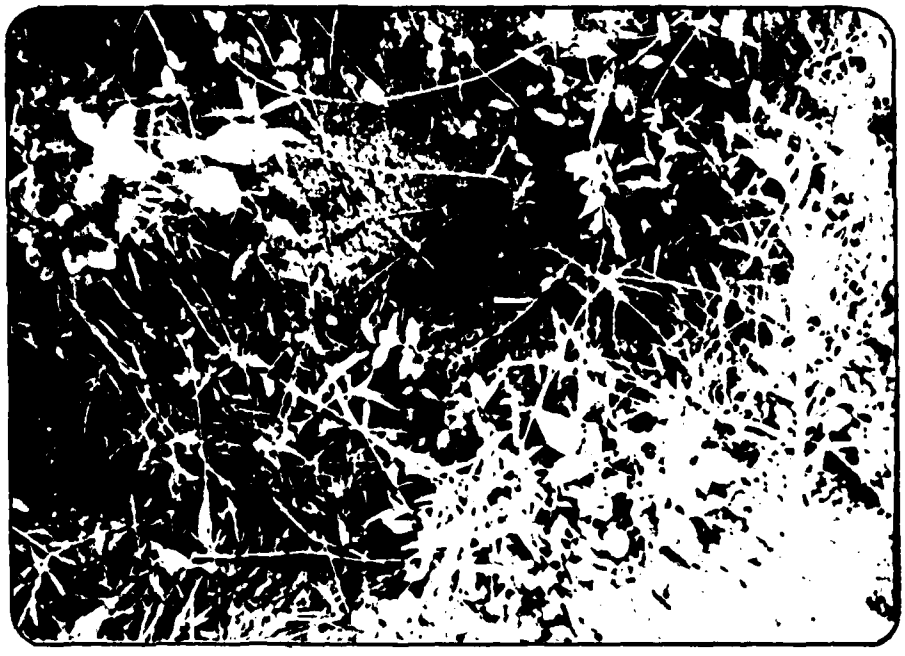


PHOTO 11. View of One of the Seepage and Piping Holes at Right End of Right Embankment

PHOTO 12. View of Seepage and Piping Hole Downstream at Right End of Right Embankment

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject DEER LAKE DAM S.O. No.
APPENDIX D- HYDROLOGIC Sheet No. of
AND HYDRAULIC CALCULATIONS Drawing No.
Computed by LAD Checked by Date

SUBJECT	PAGE

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic determinations presented in this Phase I Inspection Report are based on the use of a Snyder's unit hydrograph developed by the U.S. Army Corps of Engineers. Due to the limited number of gaging stations available in this hydrologic region and the wide variations of watershed slopes, the Snyder's coefficients may yield results of limited accuracy for this watershed. As directed however, a further refinement of these coefficients is beyond the scope of this Phase I Investigation.

In addition, the conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: DEER LAKE DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.2 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	DEER LAKE DAM				
Drainage Area (square miles)	4.93				
Cumulative Drainage Area (square miles)	4.93				
Adjustment of PMF for Drainage Area (%)[2]	Zone 7				
6 Hours	102				
12 Hours	120				
24 Hours	130				
48 Hours	140				
72 Hours	--				
Snyder Hydrograph Parameters					
Zone [3]	25				
C_p/C_t [4]	0.4/1.0				
L (miles) [5]	4.51				
L_{ca} (miles)[5]	2.37				
$t_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)	2.04				
Spillway Data					
Crest Length (ft)	54.9				
Freeboard (ft)	2.5				
Discharge Coefficient	2.68				
Exponent	1.5				

(Data for center spillway only; dimensions and rating curves for 2 additional spillways are on sheets 5-9)

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

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THE BAKER ENGINEERS

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Beaver, Pa. 15009

Subject DEER LAKE DAM S.O. No.
HYDRAULIC DATA Sheet No. 2 of 15
Drawing No.
Computed by LAD Checked by Date 7/30/80

STORAGE INFORMATION

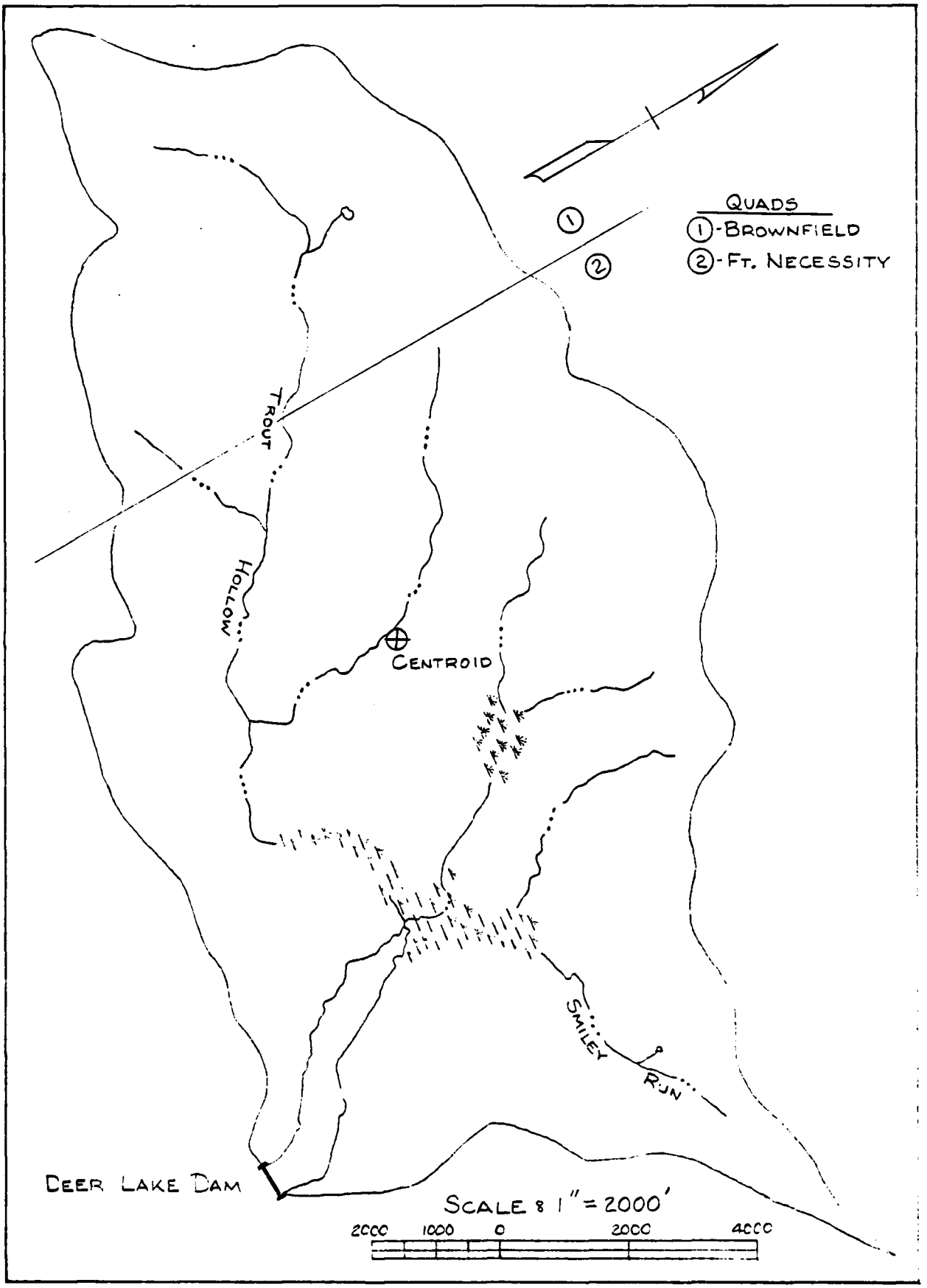
Area vs Elevation

Elevation	Surface Area (acres)
1916.5 **	2 **
1924.5 **	40 **
1929.0 *	60 *
1940.0 *	220 *

* Measured from U.S.G.S. Topographic Quadrangle

** Depth and area estimated from survey information and average reservoir side slopes

NOTE: Normal Pool assumed to be at elevation of Concrete Weir in Principal Spillway in center of Dam (El. 1929.0 ft. from U.S.G.S. Quad).


QUADS
① - BROWNFIELD
② - FT. NECESSITY
①
②
TROUT
HOLLOW
CENTROID
SMILEY
RUN
DEER LAKE DAM
SCALE 1" = 2000'
2000 1000 0 2000 4000

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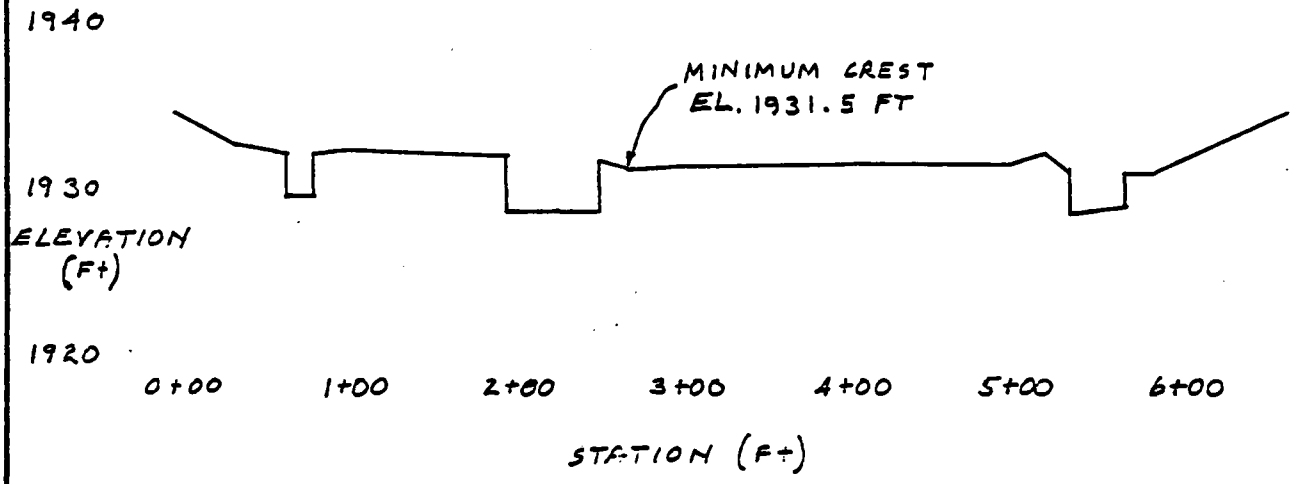
THE BAKER ENGINEERS

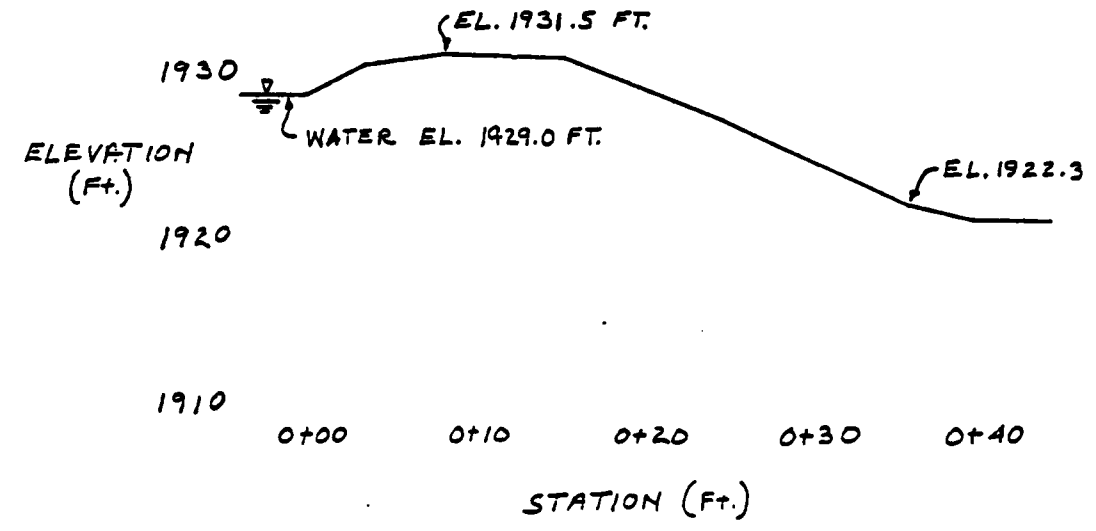
Box 280
Beaver, Pa. 15009

Subject DEER LAKE DAM S.O. No.
TOP OF DAM PROFILE Sheet No. 4 of 15
AND DAM CROSS SECTION Drawing No.
Computed by LAD Checked by Date 7/22/80

TOP OF DAM PROFILE



CROSS SECTION AT STA. 2+70



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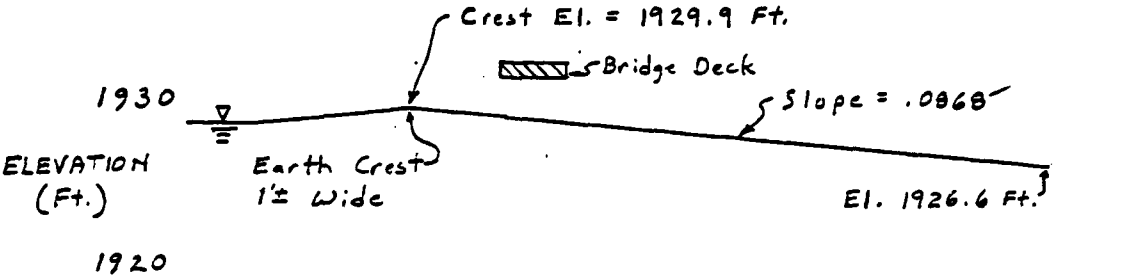
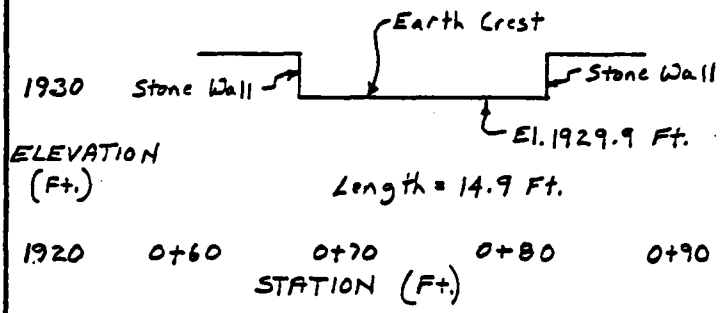
Box 280
Beaver, Pa. 15009

Subject DEER LAKE DAM S.O. No.
EARTH SPILLWAY & Sheet No. 5 of 15
LEFT SIDE OF DAM, RATING Drawing No.
Computed by LAD Checked by WLS Date 7/23/80

SPILLWAY PROFILE



TOP OF DAM PROFILE



Spillway Rating:
For open channel flow assume critical flow at control section (earth crest at El. 1929.9).
Determine discharge rating using $V = \sqrt{gD}$ and $Q = VA$
where: V = Velocity (Ft/sec)
g = 32.2 Ft./sec
D = Mean Hydraulic Depth = Flow Area / Topwidth
A = Flow Area (Sq. Ft.)
Q = Discharge (cfs)
From: Page 43, Chow, Open Channel Hydraulics,

FLOW AT SPILLWAY CONTROL SECTION (SPILLWAY CREST)

Depth (ft.)	Elevation (Ft)	V (Ft/sec)	A (Ft²)	Q (cfs)	V²/2g	RESERVOIR SURFACE ELEVATION (EGL)
0.1	1930.0	1.79	1.49	2.67	.05	1930.05
0.7	1930.6	4.75	10.43	49.54	.35	1930.95
1.1	1931.0	5.95	16.39	97.52	.55	1931.55
1.7	1931.6	7.40	25.33	187.44	.85	1932.45
2.1	1932.0	8.22	31.29	257.20	1.05	1933.05
2.6	1932.5	9.15	38.74	354.47	1.30	1933.80
3.1	1933.0	9.99	46.19	461.44	1.55	1934.55

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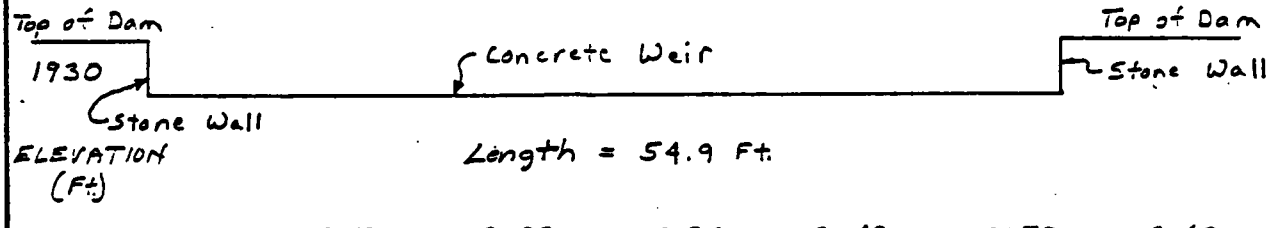
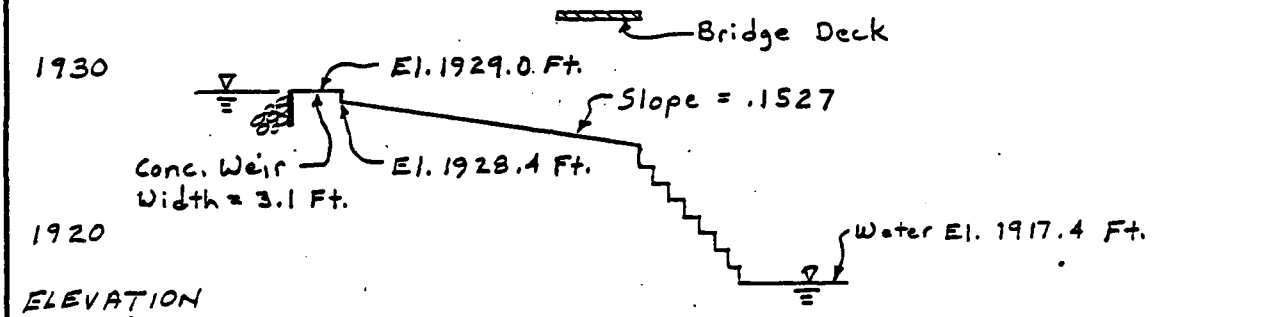
Box 280
Beaver, Pa. 15009

Subject DEED LAKE DAM — CONCRETE SPILLWAY AT CENTER OF DAM, RETAINING — S.O. No.
Sheet No. 6 of 15
Drawing No.
Computed by LAD Checked by WCS Date 7/23/80

TOP OF DAM PROFILE



SPILLWAY PROFILE



$Q = CLH^{3/2}$ C Values from King & Brater Pg 5-40 Table 5-3

$Q = (2.68)(54.9)(.6)^{3/2}$
$= 68.38$ cfs (El. 1929.6)

$Q = (2.65)(54.9)(1.0)^{3/2}$
$= 145.49$ cfs (El. 1930)

$Q = (2.68)(54.9)(1.6)^{3/2}$
$= 297.77$ cfs (El. 1930.6)

$Q = (2.72)(54.9)(2.0)^{3/2}$
$= 422.36$ cfs (El. 1931.)

$Q = (2.81)(54.9)(2.5)^{3/2}$
$= 609.80$ cfs (El. 1931.5)

$Q = (2.92)(54.9)(3.0)^{3/2}$
$= 832.98$ cfs (El. 1932.)

$Q = (2.97)(54.9)(3.5)^{3/2}$
$= 1067.65$ cfs (El. 1932.5)

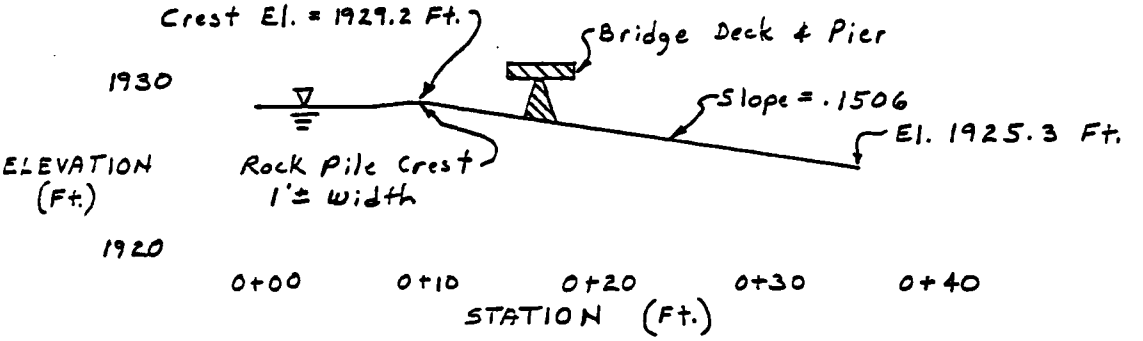
$Q = (3.07)(54.9)(4.0)^{3/2}$
$= 1348.34$ cfs (El. 1933.)

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

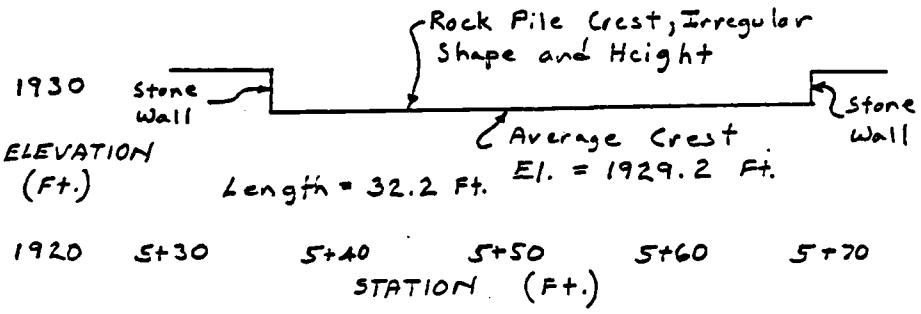
Box 280
Beaver, Pa. 15009

Subject DEER LAKE DAM — S.O. No.
ROCK PILE SPILLWAY AT — Sheet No. 7 of 15
RIGHT SIDE OF DAM, RATING — Drawing No.
Computed by LAD — Checked by WLS — Date 7/24/90

SPILLWAY PROFILE



TOP OF DAM PROFILE



Spillway Rating:
For open channel flow assume critical flow at control section (Rock Pile Crest at El. 1929.2). Determine discharge rating using $V = \sqrt{gD}$ and $Q = VA$ where:
V = Velocity (Ft/sec)
g = 32.2 Ft/sec
D = Mean Hydraulic Depth = $\frac{\text{Flow Area}}{\text{Topwidth}}$
A = Flow Area (Sq. Ft.)
Q = Discharge (cfs)
(From CHOW; OPEN CHANNEL HYDRAULICS, PAGE 93)

FLOW AT SPILLWAY CONTROL SECTION (SPILLWAY CREST)

Depth (ft.)	Elevation (ft.)	V (Ft/sec.)	A (Ft²)	Q (cfs)	V²/2g	RESERVOIR SURFACE ELEVATION (EGL)
0.4	1929.6	3.59	12.88	46.22	.20	1929.80
0.8	1930.0	5.05	25.76	130.86	.40	1930.40
1.4	1930.6	6.71	45.08	302.49	.70	1931.30
1.8	1931.0	7.61	57.96	441.08	.90	1931.90
2.4	1931.6	8.79	77.28	679.29	1.20	1932.80
2.8	1932.0	9.50	90.16	856.52	1.40	1933.40
3.3	1932.5	10.31	106.26	1095.54	1.65	1934.15
3.8	1933.0	11.06	122.36	1353.30	1.90	1934.90

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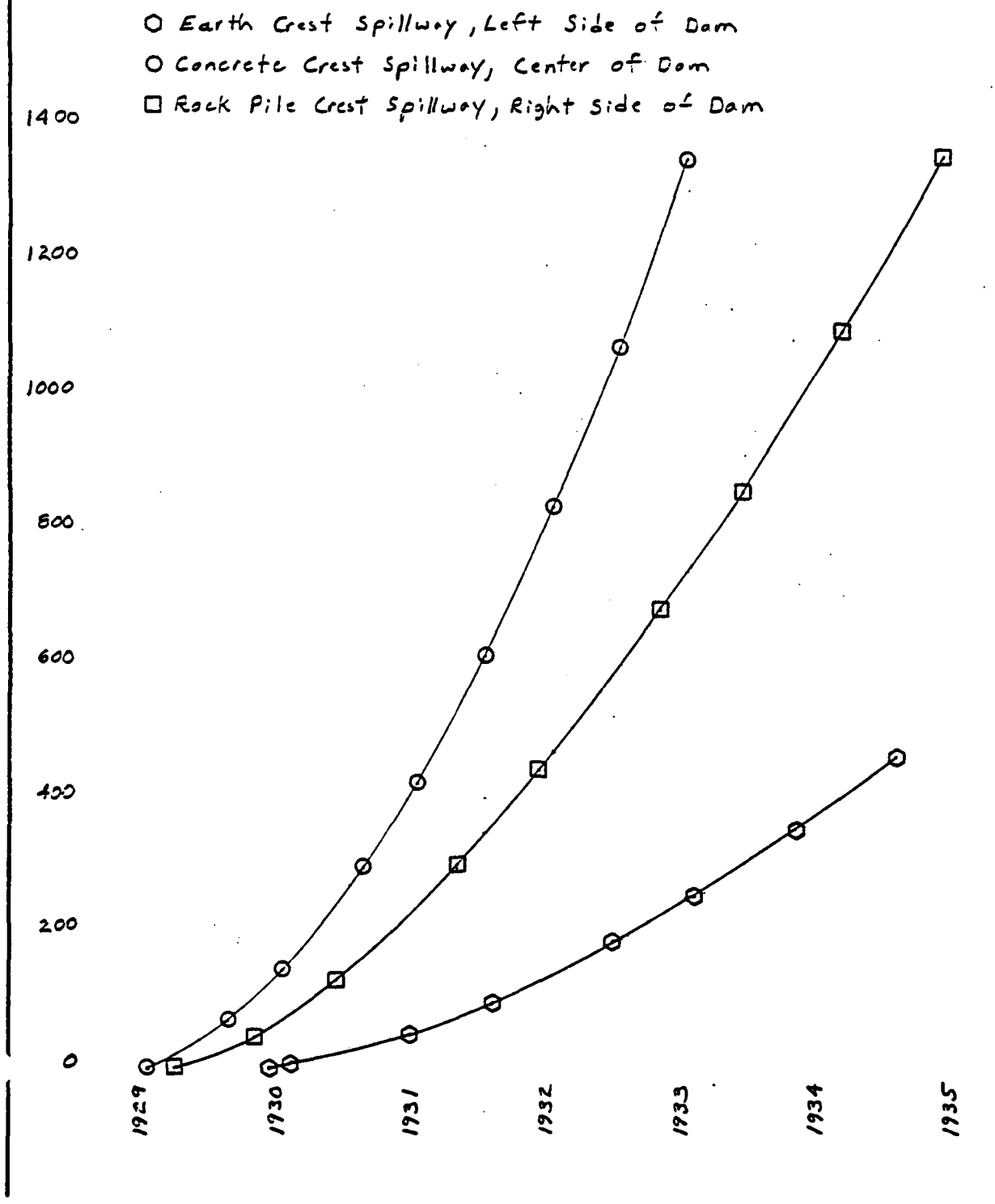
Subject DEED LAKE DAM S.O. No.
DISCHARGE VS RESERVOIR ELEVATION Sheet No. 8 of 15
RATING CURVES FOR 3 SPILLWAYS Drawing No.
Computed by EAD Checked by Date 7/24/90



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Subject DEEP LAKE DAM S.O. No.
DISCHARGE SUMMATION Sheet No. 9 of 15
FOR 3 SPILLWAYS Drawing No.
Computed by LAD Checked by WLS Date 7/22/80

ELEVATION	DISCHARGE (CFS)			TOTAL DISCHARGE
	LEFT SPILLWAY	CENTER SPILLWAY	RIGHT SPILLWAY	
1929.0	0	0	0	0
1929.5	0	55.	19.	74.
1930.0	2.	145.	70.	217.
1930.5	25.	270.	145.	440.
1931.0	52.	422.	240.	714.
1931.5	90.	610.	350.	1050.
1932.0	135.	833.	470.	1438.
1932.5	195.	1068.	600.	1863.
1933.0	250.	1348.	735.	2333.

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THE BAKER ENGINEERS
Box 280
Beaver, Pa. 15009

Subject DEER LAKE DAM — S.O. No.
HYDROGRAPH DATA — Sheet No. 10 of 15
Drawing No.
Computed by WLS — Checked by LAD — Date 9/1/80

DRAINAGE AREA = 4.93 SQ. MI. (MEASURED ON FORT NECESSITY AND BROWNFIELD, PA. QUADS)

LONGEST HYDRAULIC PATH TO DAM = 23,800' = 4.51 MILES (MEASURED FROM WESTERN MOST POINT OF WATERSHED)

DISTANCE FROM CENTROID TO DAM = 12,500' = 2.37 MILES

AREA OF LAKE @ EL. 1929 = 0.09 SQ. MI. = 60 ACRES

SNYDERS UNIT HYDROGRAPH COEFFICIENT

ZONE NUMBER 25

$C_p = 0.40$

$C_T = 1.0$ (PLATE N)

$T_p = C_T (L \times L_{CA})^{0.3}$

$= 1.0 (2.37 \times 4.51)^{0.3} = 2.04$ HOURS

AREA - AT ELEV. 1940 = 0.34 Sq. Mi = 220 ACRES

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  MBJ UPDATE         04 JUN 79
**********
    1              A1       NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
    2              A2       HYDROLOGIC AND HYDRAULIC ANALYSES OF DEER LAKE DAM
    3              A3       UNIT HYDROGRAPH BY SNYDERS METHOD
    4              B    300       0       50        0        0        0        0        0       -4        0
    5              J1     5
    6              J      1       4       1
    7              J1  1.00    0.50    0.25    0.10
    8              K                      1                                        1
    9              K1       RUNOFF HYDROGRAPH TO DAM
   10              M        1       1    4.93
   11              P                24.2    102.    120.    130.    140.
   12              I                                                        1.0    0.05
   13              N    2.34    0.40
   14              X    -1.5   -0.05     2.0
   15              K        1       2                                        1
   16              K1       ROUTING FOR DEER LAKE DAM
   17              Y                                        1       1
   18              Y1       1                                          -1929.0      -1
   19              Y41929.0  1929.5  1930.0  1930.5  1931.0  1931.5  1932.0  1932.5  1933.0
   20              Y5       0    74.0   217.0   440.0   714.0  1050.0  1439.0  1863.0  2333.0
   21              $A   2.0     40.0    60.0   220.0
   22              $E1916.5  1924.5  1929.0  1940.0
   23              $$1929.0
   24              $D1931.5     3.08     1.5   547.3
   25              $L       0   283.0   373.0   501.0
   26              $V1931.5  1932.0  1932.5  1933.0
   27              K       99
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  MBJ UPDATE         04 JUN 79
**********

RUN  DATE 08/01/80
     TIME    03.40


                    NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
                    HYDROLOGIC AND HYDRAULIC ANALYSES OF DEER LAKE DAM
                    UNIT HYDROGRAPH BY SNYDERS METHOD

                                    JOB SPECIFICATION
          NQ     NDR     NMIN    IDAY    IHR    IMIN   METRC    IPLT    IPRT   NSTAN
         300       0       30       0      0       0       0       0      -6       0
                                  JOPER     NAT   LROPT   TRACE
                                      5       0       0       0       0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 4 LRTIO= 1
                    RTIOS=   1.00   0.50   0.25   0.10

**********      **********      **********      **********      **********

                                SUB-AREA RUNOFF COMPUTATION

                    RUNOFF HYDROGRAPH TO DAM

                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                              1       0       0       0       0       0       1       0       0

                                    HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO  ISNOW   ISAME   LOCAL
              1       1    4.93     0.0    4.93     0.0     0.0      0       0       0

                                    PRECIP DATA
                    SPFE     PMS      R6      R12     R24     R48     R72     R96
                     0.0   24.20  102.00  120.00  130.00  140.30     0.0     0.0
TRSPC COMPUTED BY THE PROGRAM IS 0.800

                                    LOSS DATA
          LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOR   STRTL   CNSTL   ALSMX   RTIMP
              0     0.0     0.0    1.00     0.0     0.0    1.00    1.00    0.05     0.0     0.0

                                UNIT HYDROGRAPH DATA
                              TP=  2.04   CP=0.43   NTA=  0

                                RECESSION DATA
                          STRTQ=   -1.50   QRCSN=   -0.05   RTIOR= 2.00

          UNIT HYDROGRAPH  43 END-OF-PERIOD ORDINATES, LAG=  2.05 HOURS, CP= 0.43  VOL= 1.00
            62.     227.     447.     589.     609.     545.     478.     413.     368.     323.
           283.     243.     218.     191.     167.     147.     129.     113.      97.      87.
            76.      67.      59.      51.      45.      40.      35.      30.      27.      23.
            21.      18.      16.      14.      12.      11.       9.       8.       7.       6.
```

Sheet No. 12 of 15

				6.	5.	4.							
						END-OF-PERIOD FLOW							
	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q		MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
								SUM				27.10	24.68	2.42	16535.
												688.11	627.11	61.31	4933.30

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTING FOR DEER LAKE DAM

ISTAQ	ICOMP	ICOQW	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

JLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.0	0.0	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	=1929.	=1

STAGE	1929.00	1929.50	1930.00	1930.50	1931.00	1931.50	1932.00	1932.50	1933.00
FLOW	0.0	74.00	217.00	440.00	714.00	1050.00	1454.00	1863.00	2333.00
SURFACE AREA=		2.	40.	60.	220.				
CAPACITY=		0.	136.	359.	1807.				
ELEVATION=		1917.	1925.	1929.	1940.				

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1929.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1931.5	3.1	1.5	547.

CREST LENGTH AT OR BELOW ELEVATION	0.	283.	373.	501.
	1931.5	1932.0	1932.5	1933.0

PEAK OUTFLOW IS 8991. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 4472. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 2144. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 755. AT TIME 43.50 HOURS

********** ********** ********** ********** **********

Sheet No. 13 of 15

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4
				RATIOS APPLIED TO FLOWS			
				1.00	0.50	0.29	0.10
HYDROGRAPH AT	1	4.93	1	9132.	4566.	2283.	913.
		(12.77)		(258.58)(	129.29)(	64.64)(	25.86)(
ROUTED TO	2	4.93	1	8991.	4472.	2144.	755.
		(12.77)		(254.60)(	126.63)(	60.72)(	21.37)(

Sheet No. 14 of 15

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1929.00	1929.00	1931.00
STORAGE	359.	359.	543.
OUTFLOW	0.	0.	1000.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1934.37	2.87	847.	8921.	17.00	42.50	0.0
0.50	1933.21	1.71	711.	4472.	11.50	42.50	0.0
0.25	1932.34	0.84	621.	2164.	6.50	43.00	0.0
0.10	1931.06	0.0	505.	795.	0.0	43.50	0.0

Sheet No. 15 of 15

APPENDIX E

PLATES

CONTENTS

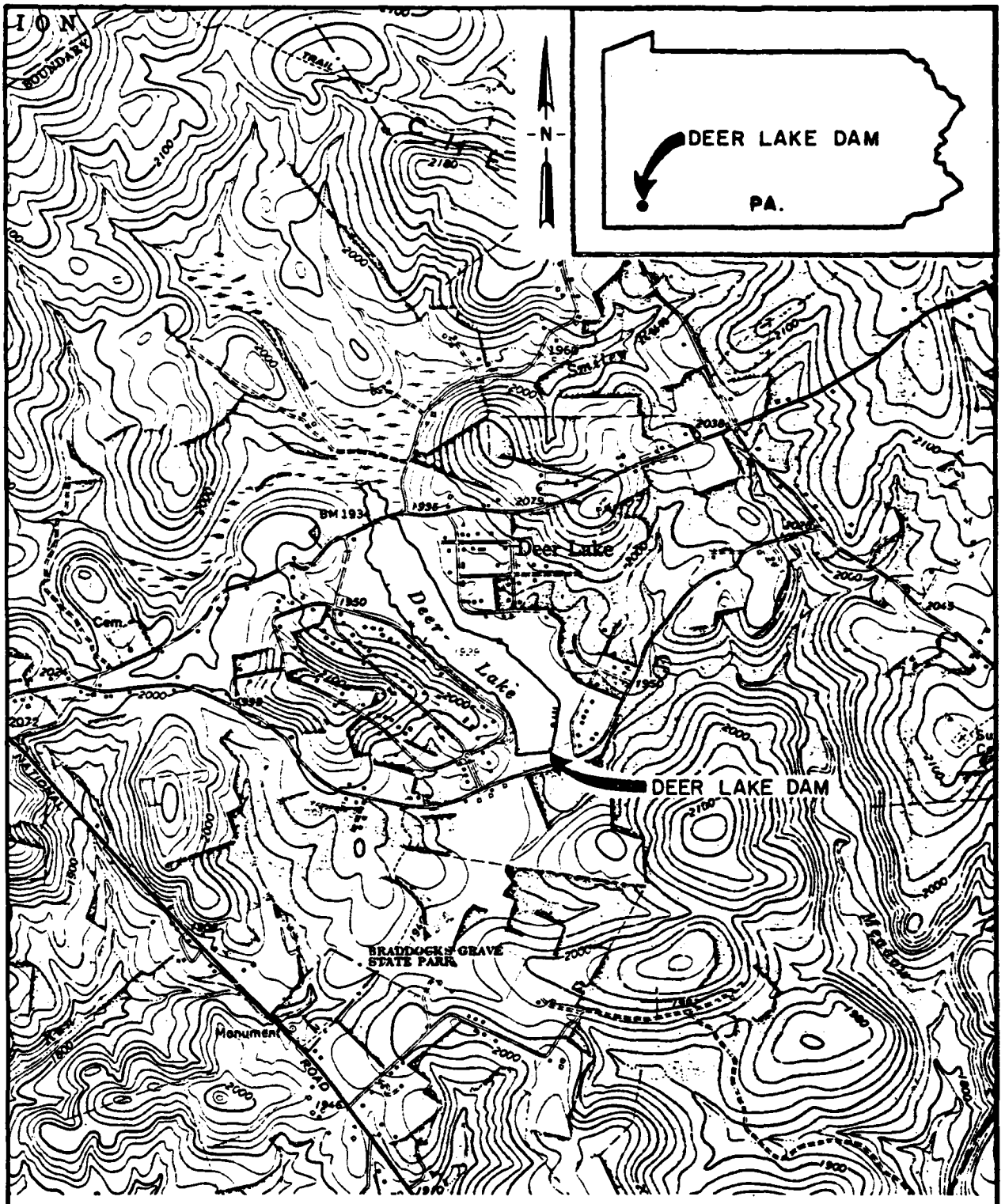
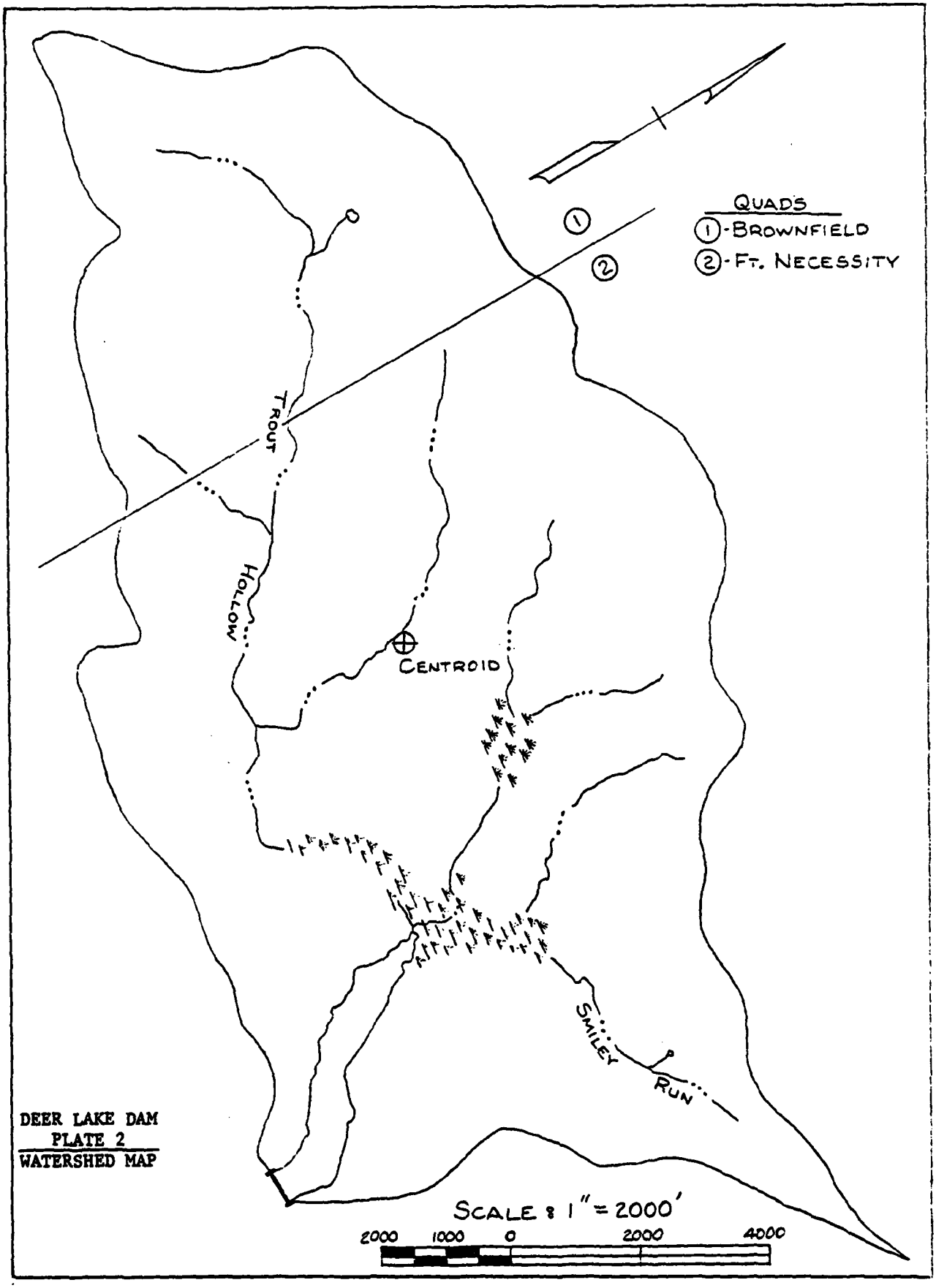
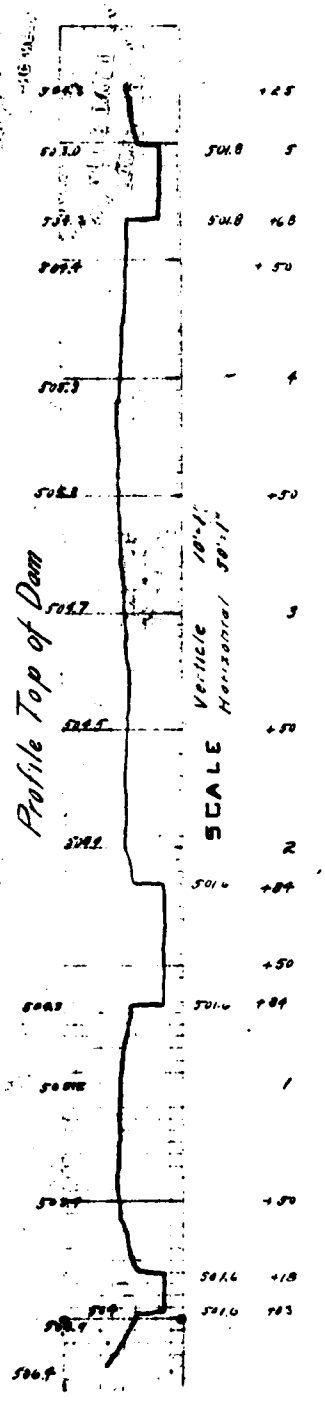


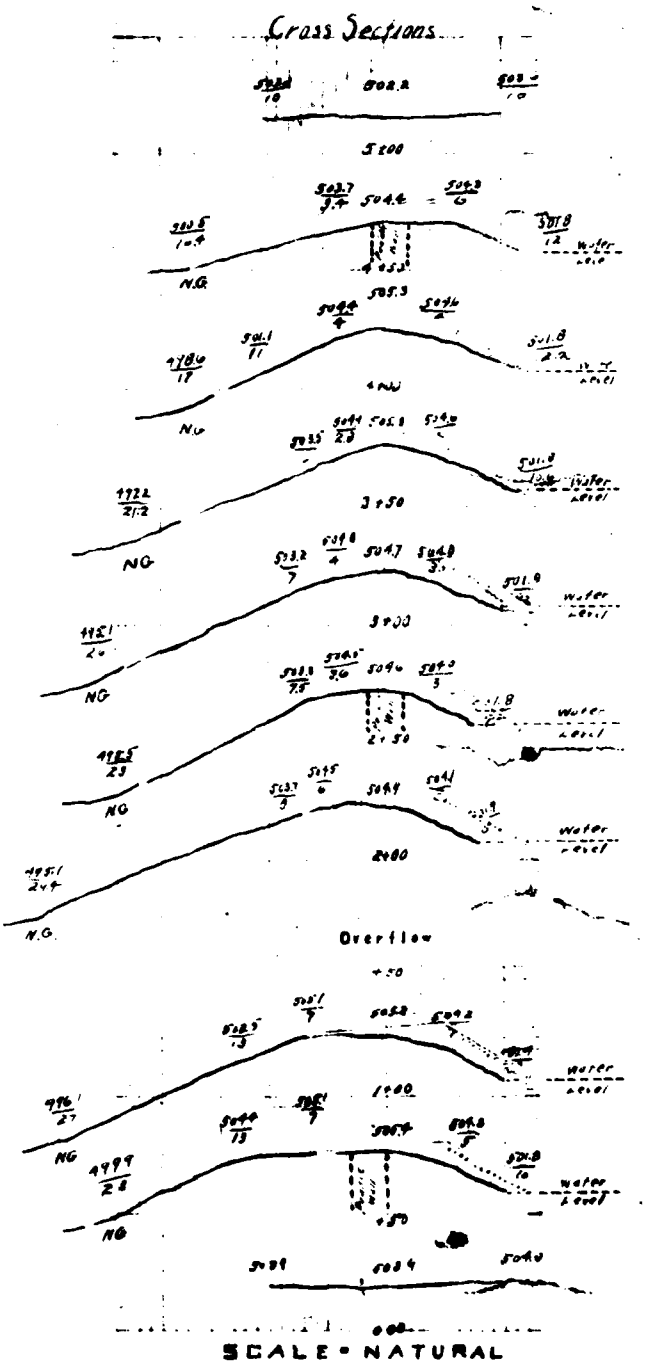
PLATE 1 LOCATION PLAN

DEER LAKE DAM



DEER LAKE DAM
PLATE 2
WATERSHED MAP





SCALE - NATURAL

PLATE 3

CROSS SECTION SHOWING PROPOSED INCREASED EMBANKMENT O.H. SEATON'S LAKE

WHARTON TWP. FAYETTE CO. PA.

July 1916

APPENDIX F

REGIONAL GEOLOGY

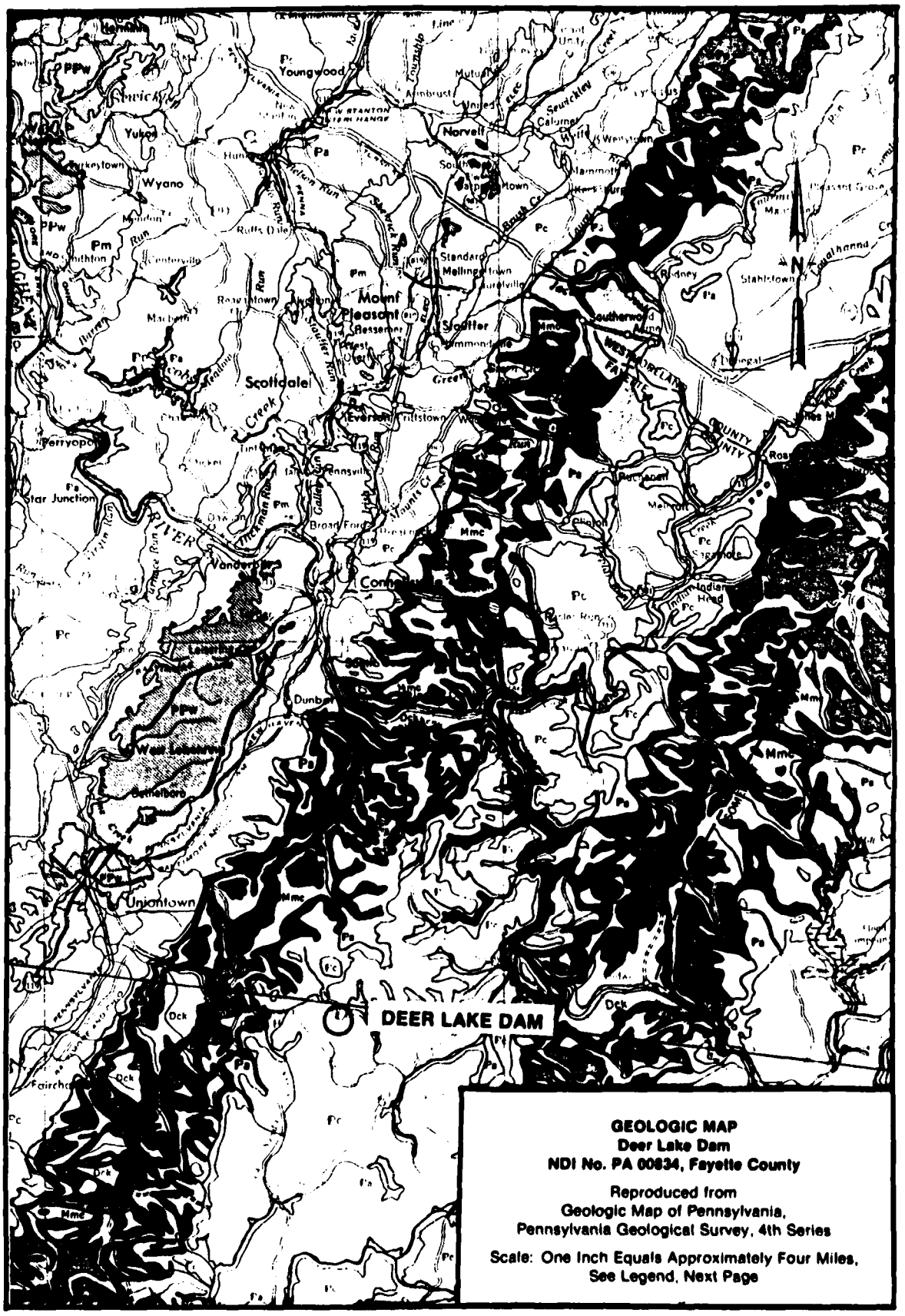
DEER LAKE DAM
NDI No. PA 01139, PennDER No. 26-53
Fayette County

REGIONAL GEOLOGY

Deer Lake Dam is in the Allegheny Mountain Section of the Appalachian Plateaus physiographic province. The area has not been glaciated and bedrock units below the dam are members of the Glenshaw Formation, Conemaugh Group, Pennsylvanian System. This formation consists of cyclic sequences of sandstone, shale, red beds, and thin limestone and coal.

Several coal seams are possibly located beneath the dam, including the Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning, Clarion, Brookville, and Mercer coals. The thicknesses of the coals beneath the dam are not known. According to "Bituminous Coal Resources in Western Pennsylvania" by M.A. Sholes and V.W. Skema (1974), Pennsylvania Bureau of Topographic and Geologic Survey, Mineral Resource Report 68, no mining activity had occurred in the immediate vicinity of the dam at the time of publication.

The Loyalhanna limestone is located at a great depth (estimated 700 feet) beneath the dam; however, it is known to have several caverns (notably the "Laurel Caverns" near Summit, Pennsylvania). No problems were observed at the dam site related to this formation.



GEOLOGIC MAP
Deer Lake Dam
NDI No. PA 00634, Fayette County

Reproduced from
Geologic Map of Pennsylvania,
Pennsylvania Geological Survey, 4th Series

Scale: One Inch Equals Approximately Four Miles,
See Legend, Next Page

LEGEND

PERMIAN

Greene Formation
Cyclic sequences of sandstone, shale, red beds, limestone and coal; base at the top of the Upper Washington Limestone.

PERMIAN AND PENNSYLVANIAN

Ppw

Washington Formation
Cyclic sequences of sandstone, shale, limestone and coal; some red shale; some mineable coal; base at the top of the Waynesburg Coal.

PENNSYLVANIAN

APPALACHIAN PLATEAU

Pm

Monongahela Formation
Cyclic sequences of sandstone, shale, limestone and coal; limestone prominent in northern outcrop areas; shale and sandstone increase southward; commercial coals present; base at the bottom of the Pittsburgh Coal.

Pc

Conemaugh Formation
Cyclic sequences of red and gray shales and siltstones with thin limestones and coals; massive Mahoning Sandstone commonly present at base; Ames Limestone present in middle of sections; Brush Creek Limestone in lower part of section.

Pa

Allegheny Group
Cyclic sequences of sandstone, shale, limestone and coal, numerous commercial coals, limestones thicken westward; Vanport Limestone in lower part of section, includes Freeport, Kittanning, and Clarion Formations.

Pottsville Group
Predominantly sandstones and conglomerates with thin shales and coals; some coals mineable locally.

ANTHRACITE REGION

Ppt

Post-Pottsville Formations
Brown or gray sandstones and shales with some conglomerate and numerous mineable coals.

Pottsville Group
Light gray to white, coarse grained sandstones and conglomerates with some mineable coal; includes Sharp Mountain, Schuylkill, and Tumbling Run Formations.

MISSISSIPPIAN

Mmc

Mauch Chunk Formation
Red shales with brown to greenish gray flaggy sandstones, includes Greenbrier Limestone in Fayette, Westmoreland, and Somerset counties, Loyalhanna Limestone at the base in southwestern Pennsylvania.

Pocono Group
Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale, includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Corry, and Knapp Formations, includes part of "Oswayo" of M. L. Fuller in Potter and Tioga counties.

WESTERN PENNSYLVANIA

Dos Ov

Oswayo Formation
Greenish gray to gray shales, siltstones and sandstones becoming increasingly shaly westward; considered equivalent to type Oswayo. Riceville Formation Dr in Erie and Crawford Counties, probably not distinguishable north of Corry.

Dcr

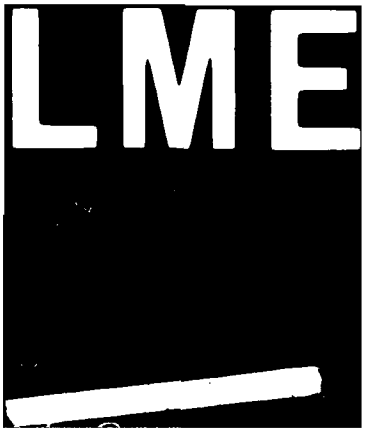
Cattaraugus Formation
Red, gray and brown shale and sandstone with the proportion of red decreasing westward; includes Venango sands of drillers and Salamanca sandstone and conglomerate; some limestone in Crawford and Erie counties.

Dct

Conneaut Group
Alternating gray, brown, greenish and purplish shales and siltstones, includes "pink rock" of drillers and "Chemung" and "Girard" Formations of northwestern Pennsylvania.

Dca

Canadaway Formation
Alternating brown shales and sandstones includes "Portage" Formation of northwestern Pennsylvania.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